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CONTENTS

Editorial 47

Acid Copper for Decorative Plating 48
By John F. Beaver

The Use of Graphite in Metal Finishing Operations .. 51
By J. R. Murphy

Treatment of Plating Wastes 56
By E. G. Kominek

Reducing Finishing Costs Through Modern Techniques 63
By Dr. S. Wernick

Where Do We Go From Here?—Part I 71
By Joseph B. Kushner

Shop Problems 74

Patents 76

Engineering Data Sheet 78

Recent Developments 79

Technical Literature 89

Business Items 89

Associations and Societies 95

News from California 102

Manufacturers' Literature 103

New Books 105

COMING SOON

Electropolishing of silver flatware and holloware, as practiced at one of the largest firms in the country.

Methods for the economical finishing of Monel metal.

An article on the process for tin coating the inside of long tubular parts with tin in an immersion bath.

The importance and value of silicates in metal cleaning compositions, including their effect on zinc-base die castings.

The conditions under which perchloric acid-acetic acid electropolishing baths may be safely employed.

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VOTED EXCLUSIVELY TO METALLIC SURFACE TREATMENTS

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Magnesium and the Plating Industry

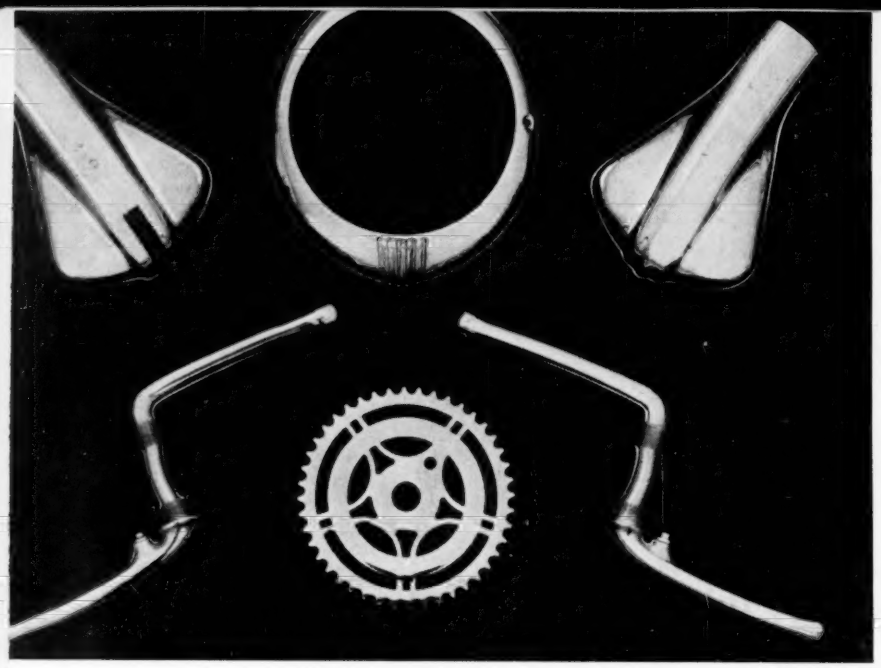
One of the trends that has been apparent to platers and finishing men during the past few years has been the increasing use of aluminum in products requiring decorative or protective plating. At the present time this metal is quite common to most plating departments, and techniques for its successful processing have been worked out in detail, whereas a few years back most plating men would have considered it a "rare metal".

It now appears that magnesium may be next on the list to follow the same path. Reliable reports indicate that several of the largest automobile manufacturers are seriously considering the use of magnesium alloy die-castings as a replacement for at least some of the zinc-base alloys now so widely used. This could be a development of far-reaching importance to metal finishers, as industry in general has a high regard for Detroit engineering genius, and is usually quick to adopt any new applications and procedures emanating from the Motor City.

If and when such a changeover is made, it will be based on sound engineering and economic factors. At today's metal prices there is much that can be said for such a switch. The relative per-pound price of die-cast parts in both these metals is presently such that the higher strength/weight ratio of magnesium alloys makes it the logical choice for many applications. Four times as many magnesium castings per pound, in addition to approximately equal mechanical properties such as tensile strength, elongation, etc. are hard to overlook for economy-minded designers. Lest the magnesium advocates wax over-optimistic, however, there are the drawbacks of inferior impact strength of the magnesium alloys to restrict their use for certain parts, size limitations for the largest parts, plus the poignant problem of replacement of present zinc die-casting machines with the completely different type required for casting magnesium alloys. Detroit's seemingly unconcerned attitude towards new tooling and machinery costs may make this last drawback of lesser importance than is generally felt.

Fortunately, methods for providing decorative and protective surfaces on magnesium alloys have recently been developed (See "Electroplating Magnesium Alloys"—METAL FINISHING, July 1948), a fact that will play an important part in the ultimate decision.

Plating men would do well to become thoroughly familiar with these new techniques, especially in those plants where equipment and processes are set up for finishing zinc-base alloys. Specifications for plated magnesium parts are certain to be rigid, and only those who have mastered the intricacies of magnesium finishing will be able to operate profitably in this field.



Typical group of bright copper plated parts.

Acid Copper for Decorative Plating

By John F. Beaver, *Chief Chemist, Dayton Bright Copper Co.*

THE acid copper plating solution is one of the oldest methods of electroplating known, and perhaps the first solution to be used commercially. It dates from the beginning of the last century when the principles of electrodeposition were first discovered. Earliest commercial usage was in the production of molds and reproductions, and this continues to be an increasingly important field today. The rapid growth of the phonograph record industry is an example, where electroforming of the record disc in an acid copper solution is a vital part of the process. Electrotyping and rotogravure printing are other examples. The largest use of the acid copper solution has been, and continues to be, in the electrorefining of copper. This process was first used in the latter part of the 19th century. Its advantages in producing a purer product soon became recognized, until today virtually all copper is refined in this manner.

In the decorative field, acid copper was not used to any appreciable extent until the development of the automotive industry spurred the demand for heavier deposits. The advantages of acid copper in producing these heavier deposits were recognized, and for a time it became rather widely used. Later, with the advent of the newer copper solutions capable of producing these heavier deposits, as well as high-speed nickel solutions, the acid copper solution was pushed back into a place of semi-retirement.

Recent developments and improvements, however, tend to confirm the belief that acid copper is making a come-back. Today it is being more widely used than ever, and the next few years should show a marked increase in its use in the decorative field. It is the purpose of this article to correct some of the erroneous beliefs about acid copper, and to show that recent developments have made this solution highly desirable in many fields of decorative plating.

Advantages and Shortcomings Found in Past Usage

The typical acid copper solutions were made up as follows:

Copper Sulfate, cryst.	26-32 oz./gal.
Sulfuric Acid	6-12 oz./gal.

The seemingly high concentration of sulfuric acid was necessary to increase the conductivity of the solution to the point where suitable current densities could be obtained at voltages commonly used in the plating industry. It had a further beneficial result in producing a somewhat finer grained deposit. In addition to these basic chemicals, an addition agent was commonly used in an attempt to further reduce grain size. Such agents were usually chosen from the group consisting of molasses, phenol, dextrin, gums, etc. It was known that gelatine would produce bright, fine grained deposits, but since it was very difficult to control, and often caused brittleness, streaks, pits, etc., its use was abandoned. Current densities employed in the decorative field were usually in the neighborhood of 30-50 amps./sq. ft. though this was far from the theoretical current densities it should be possible to obtain.

Perhaps the most obvious advantage was in the cost of the solution, and its subsequent low maintenance cost. Despite the fact that the copper is present as a bivalent salt, acid copper has always proven to be the most economical method for copper deposition.

The electrorefining industry attests to this fact. In addition, the solution was easy to control and had wide operating ranges both as to concentration and temperature. Metallic impurities had but little effect on the deposit, and while the speed of deposition was in most cases not high, substantial deposits were obtained in a reasonable length of time. Furthermore, until newer copper plating solutions were developed, the acid solution was the only means of plating coatings of substantial thickness.

Chief among the shortcomings of the acid copper was the coarse grain size of the deposit, which made buffing costs correspondingly high. While the deposits were soft, it was necessary to remove considerable metal before obtaining a bright surface free from defects. Further trouble was often encountered when the acid solution attacked recessed areas of some parts, causing roughness and poor corrosion resistance. The throwing power was not considered to be good, and it was often necessary to put considerably more copper on some areas than needed, in order to get a minimum thickness on a recessed area.

Recent Developments

Within the past few years a considerable amount of research work on acid copper has been performed. The object in mind has been to utilize more fully its inherent advantages of low cost and high speed, and to overcome or minimize its shortcomings. Most of these investigations have proceeded in the direction of better addition agents, which would give either finer-grained deposits for easier buffing, or truly bright deposits suitable for direct plating of bright nickel and chromium. Several new addition agents have been reported, and at least one of these is now on the market. As a result of this work on addition agents, a considerable amount of general information on the characteristics of acid copper has also been accumulated, all of which brightens the future of acid copper in the decorative field. In the light of these developments, let us review the former shortcomings of the acid solution to determine to what extent they have been overcome.

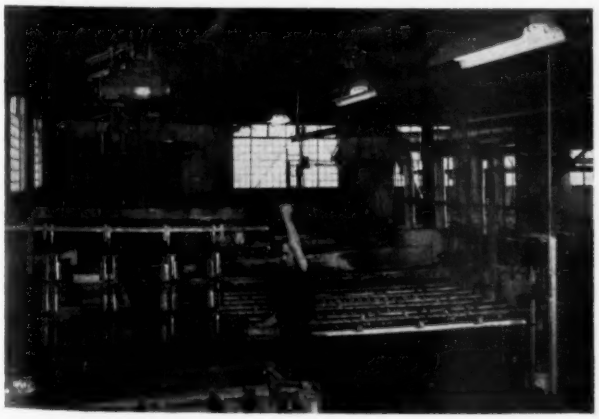


Figure 1. Load of parts after removal from the bright copper tank.

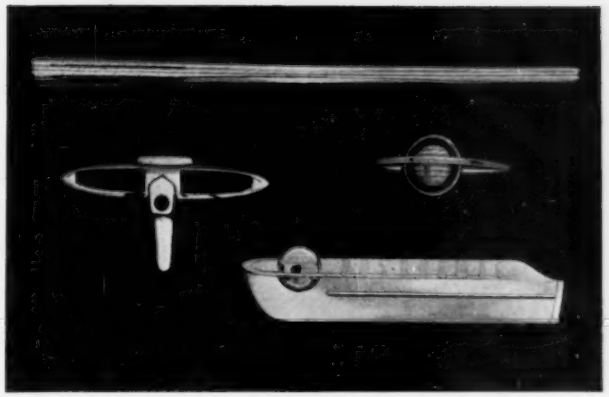


Figure 2. Group of automotive parts treated in the acid bright copper bath.

Coarse Grain

This point has been completely eliminated by the use of proper addition agents. It is now possible to produce smooth, bright, deposits suitable for direct nickel and chrome plating. Many zinc die castings are now being plated with bright acid copper in this manner. Furthermore, it has been found that these bright deposits are characterized by a very pronounced levelling action, that is, the ability to fill in and smooth out minor defects and fine polishing marks in the base metal. This is illustrated in Figure 3 showing surface roughness before and after plating. Because of this factor it has been possible in some cases to eliminate a polishing or buffing operation. In any event, buffing of these deposits is remarkably easy, due to their softness and smoothness. Further developments along this line are to be expected.

Speed of Deposition

While the speed of deposition in the early usage of acid copper was in most instances not high, the theoretical speed which can be obtained is practically unlimited. Electroforming operations at 1000 amps/sq. ft. have been reported. Due to the cost of equipment however, such speeds are not practical in the decorative field. Usual current densities have been in the neighborhood of 30-40 amps./sq. ft. but by taking advantage of the cathode depolarizing effect of the new addition agents, as well as more effective means of agitation, it is now entirely practical to plate at currents of 100 amps/sq. ft. At this amperage, 0.001" of copper is deposited in 10 minutes, which is an extremely rapid rate for decorative plating. Thus, by converting to an improved acid copper it is often possible to double production without installing new tanks, conveyors, etc.

Throwing Power

The throwing power of acid copper is admittedly not good, but investigation has proven that it is not as poor as formerly thought. Improved racking of parts has tended to further minimize this factor. Thickness determinations show that the throwing power of acid copper is somewhat better than most bright nickel solutions.

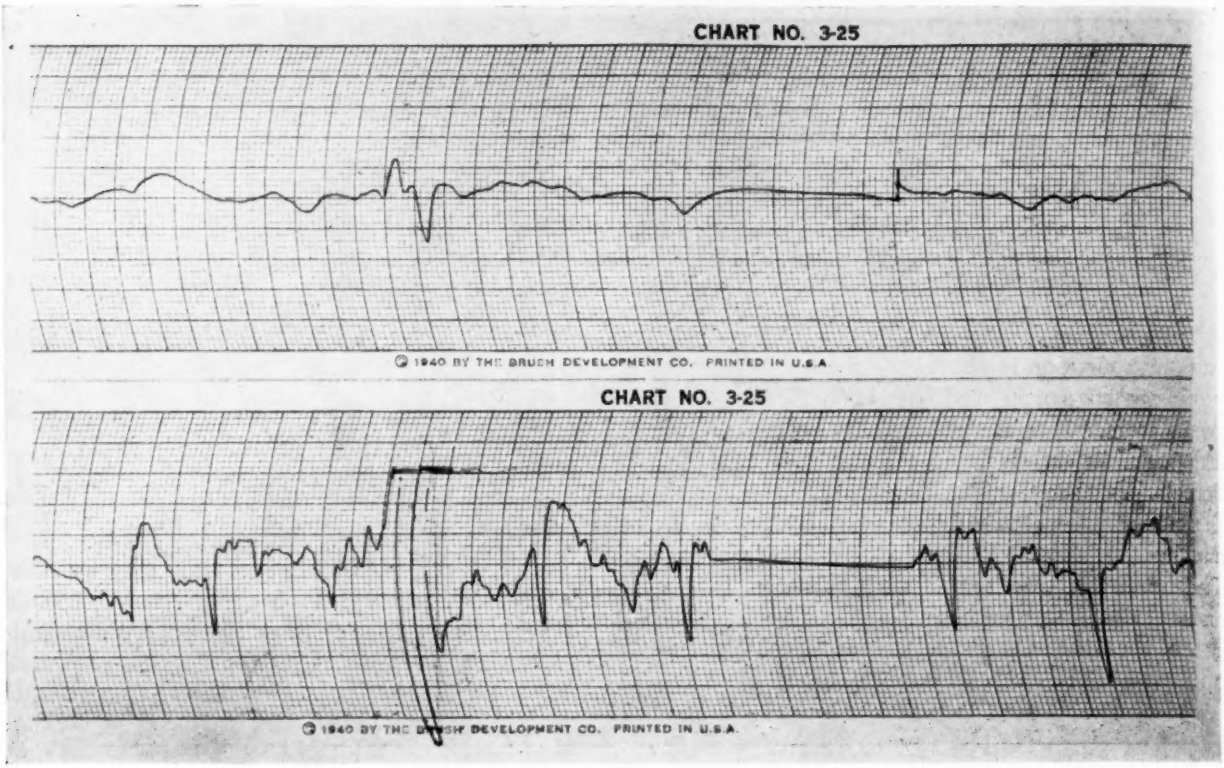


Figure 3. Surface analyzer readings on a steel panel before and after plating .001" bright acid copper.

For example, a curved test section plated at an average current density of 60 amps. per sq. ft. in both acid copper and bright nickel, gave the following comparison between a high current density edge and a deeply recessed area.

	Edge	*Recess*
Copper	.00156"	.00048"
Nickel	.00160"	.00044"

As with bright nickel, the cost savings effected by using a bright acid copper have proven to more than offset the cost of the excess copper deposited on the high current density areas. Where the copper is to be buffed, this extra copper on the prominent surfaces is often an advantage, since these surfaces are hit harder by the buff, thereby removing more copper. Thus "cut-throughs" and thin spots are greatly reduced.

Covering Power

The covering power of acid copper is excellent, being approximately equal to cyanide copper in this respect. The attack of recessed areas by acid copper has been proven not to be due to poor covering power, but either to poor cleaning of the part, or to an insufficient strike in the cyanide copper. It is true, however, that some parts cannot be plated successfully and economically in acid copper. Very deeply recessed parts which will not cover in the cyanide copper strike will be subject to attack by the acid solution. Steel tubing is an example. Such attack, while in many cases not harmful to the part of the solution, may cause rough plating due to the suspension of tiny flakes of immersion copper throughout the plating solution. Parts lost in the tank can also cause rough plating, but since this is a milder condition, it can be overcome by a good filtration system and periodic raking of the tank bottom.

Control

One of the important advantages of acid copper is its ease of control. Contributing factors are its very high tolerance to impurities, and wide operating ranges, both as to concentration and temperature. Most metallic impurities have no effect on the deposit even when present in amounts of several grams per liter. Due to the reducing nature of the solution, chromic acid drag-in is immediately reduced to the trivalent form, which is not harmful. Iron in large amounts reduces the solubility of copper sulfate in the solution, and may in some instances tend to cause anode polarization. This can be easily overcome, however, by increasing the anode area, or raising the temperature a few degrees. Perhaps the only impurities which may harm the deposit are oils and other hydrocarbons. These organics may cause brittleness, pitting, loss of luster, etc., but they are very easily and quickly removed by a carbon filtration.

Summary

Since the development of new addition agents for acid copper plating solutions, and the more efficient utilization of inherent properties of the solution, the following advantages become evident.

1. Low cost of deposition.
2. Rapid plating speed.
3. Smooth, lustrous deposits.
4. Soft, easily buffed deposits.

The future of acid copper in the decorative field looks promising, and every progressive plater should consider the advantages of acid copper outlined above in his particular problems.

The Use of Graphite in Metal Finishing Operations

By J. R. Murphy, *Tech. Service Eng., Acheson Colloids Corp.*

NEARLY everyone is familiar with the lubricating value of powdered graphite. Its value as a conductor of electricity, while probably not so widely known, is nevertheless taken advantage of in many important applications.

Like every other material that has found commercial use, graphite also has several limitations in addition to its color and tenacity on the hands and clothing of operators. No matter how finely pulverized powdered graphite may be, it is still filtered out by small interstices, will not remain in suspension when mixed with liquids, and does not adhere to surfaces when a binder is not present. These limitations preclude the use of graphite in many applications where it would prove valuable providing it could be applied and kept where it was desired in a practical manner.

When microscopic particles of graphite are stably suspended in liquid carriers (colloidal graphite) the number of practical applications are thus greatly extended. The liquid carrier transports the graphite particles where they are needed, and in the proper concentration. The extreme fineness of the graphite particles (See Fig. 1), and their stability over long periods of time make this possible. Naturally, no one liquid carrier could have the properties required for all applications, and therefore colloidal graphite is dispersed in a large variety of fluids. At the present time, dispersions of colloidal graphite are available in distilled water, petroleum oils, castor oil, volatile hydrocarbons, alcohol, glycerine, and other special fluids. Efforts are constantly being made to produce dispersions of colloidal graphite in promising fluids and dispersions in many synthetic lubricants and silicones are now available.

The concentration of colloidal graphite required for various applications also varies quite widely. As all the dispersions are available in concentrated form, it is only necessary to select the carrier with the correct properties and dilute the concentrated dispersion the required extent. For many applications, dispersions of colloidal graphite are also available in ready-for-use concentrations.

In addition to the above properties, the ability of graphite to resist chemical action, withstand temperatures up to 600°C., and to conduct electricity, makes it ideally suited for many applications in the metal finishing industry. Among these are: (1) High temperature conveyor lubrication; (2) Automatic degreaser and parts washer lubrication; (3) Automatic plating apparatus lubrication; (4) Static elimination;

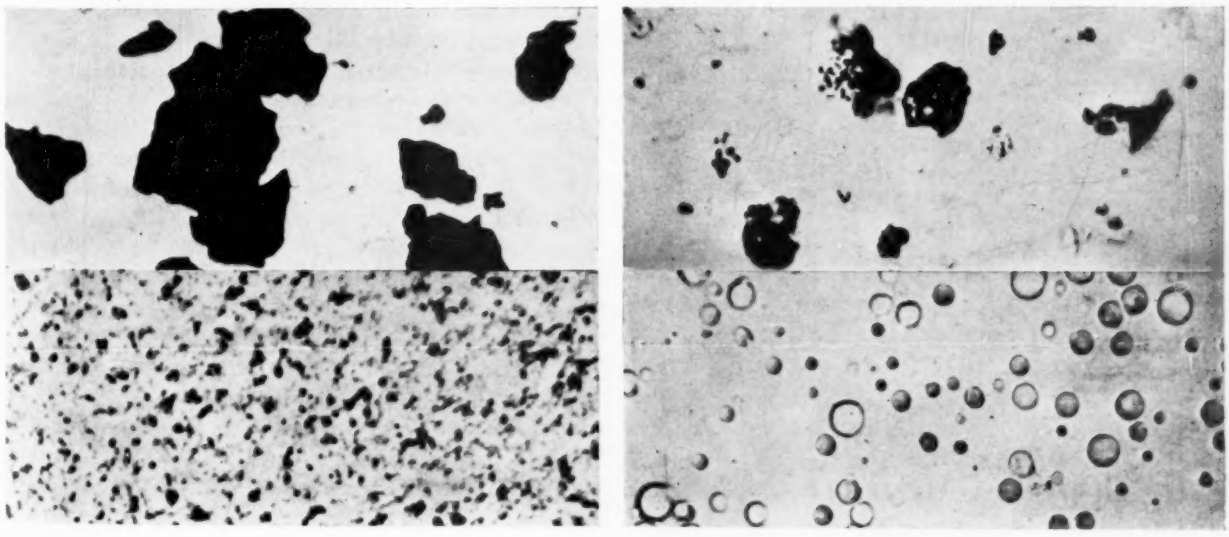


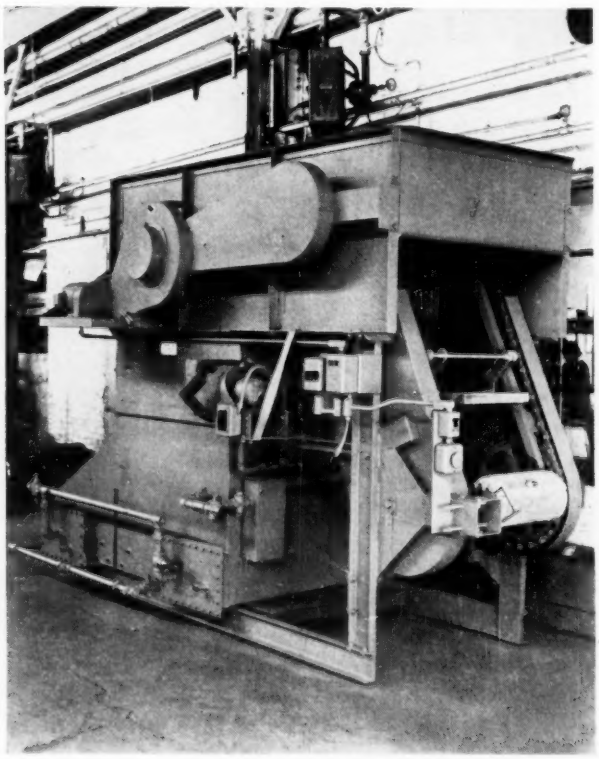
Figure 1. **Relative particle size of colloidal graphite is illustrated by comparing it with other common materials at the same magnification. (Top left) Finest commercially available powdered graphite. (Top right) Finest face powder. (Bottom left) Colloidal graphite particles. (Bottom right) Suspended fat globules in milk.**

(5) Electroplating non-conductors; (6) Stop-off for selective hot-dip tin plating.

High Temperature Conveyor Lubrication

Lubrication of conveyor ovens designed for baking resin and vitreous enamels is typical of the conveyor lubrication problems solved by colloidal graphite. Most conventional petroleum lubricants break down long before their flash point is reached, and therefore are not suitable for such an application. Upon breaking down they leave a hard carbon residue, or if they are low carbon content lubricants, burn nearly free of deposit. In the first case, repeated lubrication will finally result in enough carbon being deposited to freeze the parts concerned, as well as not providing lubrication. In the second case no lubrication is furnished after the lubricant burns, and the hot dry bearings wear rapidly. In both cases, power necessary to move the conveyor is wasted as well as the lubricant.

Graphite has been found to be an excellent material for preventing this costly wear of oven conveyor parts because of its ability to withstand heat. Colloidal graphite dispersed in suitable volatile carriers has been found the best form of graphite for this purpose because it is readily carried to every part of the mechanism which requires lubrication. In addition, the extremely fine particle size of colloidal graphite allows it to be used in automatic lubricators without danger of clogging lubricant passages. This is also true of oil grooves in the bearing themselves. This is not true of powdered graphite, regardless of how blended, because its particles are frequently large enough to clog both lubricators and oil grooves. Colloidal graphite remains in suspension in oil or mineral spirits for long periods, whereas coarser powdered graphite settles out rapidly. The volatile fluids used as carriers for colloidal graphite leave little residue. Their sole purpose in most applications is merely to carry the colloidal graphite where it is needed.



(Photo courtesy G. S. Blakeslee Co.)

Figure 2—Vapor degreaser, showing chain drives lubricated with graphite.

When a lubricant containing colloidal graphite is used on conveyor bearings, the graphite particles coat the friction surfaces of the metal and adhere tenaciously. The coating thus formed is usually so thin it cannot be detected with the most sensitive gages. Consequently, this graphite coating, called a graphoid surface, does not measurably reduce the initial clearance between mating parts. A graphoid surface has three valuable lubricating properties: First, the friction between two dry graphoid surfaces is practically the same as the friction between two surfaces lubricated by an oil film; Second, there is a much lower surface tension between an oil and a graphoid surface than between an oil and metal, thus reducing film rupture; Third, while a graphoid surface is not indestructible, its durability is many times that of an oil film. It cannot be washed off or removed except by prolonged or severe abrasion.

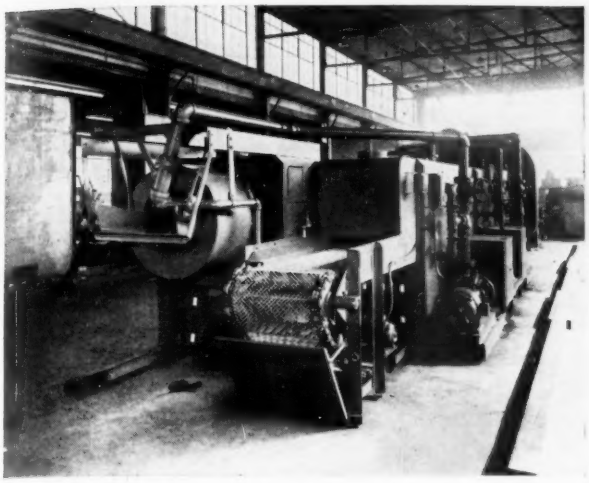
For most conveyor lubrication problems, a concentrated dispersion of colloidal graphite in mineral spirits when diluted with 9 or 10 additional parts of refined kerosene, or low carbon content straw paraffin or napthenic base oils give the best results. The choice of diluent varies with the application, depending upon the viscosity of lubricant required. A graphited lubricant may be applied by any method employed for applying conventional petroleum lubricants. For applications where extremely fine particle size is not necessary or economical, there are dispersions of semi-colloidal graphite of larger particle sizes available in mineral spirits, naptha, oil, water, etc.

Degreasers and Parts Washer Lubrication

The conventional petroleum lubricants when used for the lubrication of moving parts in automatic degreasers are usually dissolved by the fluids or their condensing vapors. Thus their lubricating value is rapidly eliminated. If the lubricants used are not soluble in the degreasing fluids, they may still be rapidly washed from the parts.

This is especially true with parts washing machines where the strong alkali used removes the conventional lubricants before they have an opportunity to provide a great deal of lubrication. For this reason, their use as lubricants in this type of equipment is far from ideal, and in addition the degreasing or washing fluids are contaminated.

As in the case of high temperature conveyor lubrication, dry films of colloidal graphite overcome these difficulties. The problem here is to obtain a dispersion of colloidal graphite that will easily apply a dry lubricating film of graphite to all the friction surfaces. The liquid carrier must be capable of evaporating rapidly, without the application of heat, and the film of graphite must have reasonable adhesion. A dispersion of colloidal graphite in alcohol has proven to be well suited for this purpose.



(*Photo courtesy G. S. Blakeslee Co.*)

Figure 3. Conveyorized washing machine belts of this type can be best lubricated with graphite.

The concentrated dispersion is normally diluted with additional alcohol or any aromatic or chlorinated hydrocarbon and applied to the conveyor chains and other moving parts with a brush. Figure 2 illustrates the conveyor chain of a typical installation lubricated in this manner. Figure 3 is an illustration of a parts washer, illustrating the mesh belt drive which is lubricated. The solvent evaporates very rapidly, leaving a thin film of graphite that is not readily washed from the parts by degreaser or washing fluids. Under normal conditions, it is necessary to apply this lubricant about once a day. As the amount of graphite applied is very small, there is little danger of contaminating the degreaser or washing fluids.

Automatic Plating Apparatus Lubrication

Automatic plating conveyors, which are being increasingly used, introduce a similar lubricating problem. Here the lubricant must be capable of conducting an electric current as well as providing lubrication. For this reason a dry film lubricant is generally preferable. A thin, dry film of graphite has a much lower electrical resistance than any fluid lubricant. Therefore, particularly for low voltage machines, such a lubricant will give better results. Here again the concentrated dispersion is diluted with additional solvent. Denatured alcohol, carbon tetrochloride, or acetone are the common diluents used.

Figure 4 illustrates a typical plating conveyor. The diluted dispersion should be painted on the bus bar at intervals of about 8 to 10 feet, which will provide ample lubrication to the shoes. Application should be made as needed, which may be several times throughout the day. Hanger pins, chains, rollers, and links are lubricated with the same mixture but application can best be made with an oil can. Here, application is necessary only once a day.

On stationary equipment a concentrated dispersion of colloidal graphite in distilled water will act as a contact cement between the bus bar and the anodes. This seals the surface from gases that lower the efficiency of the plating operation, and also provides better contact.

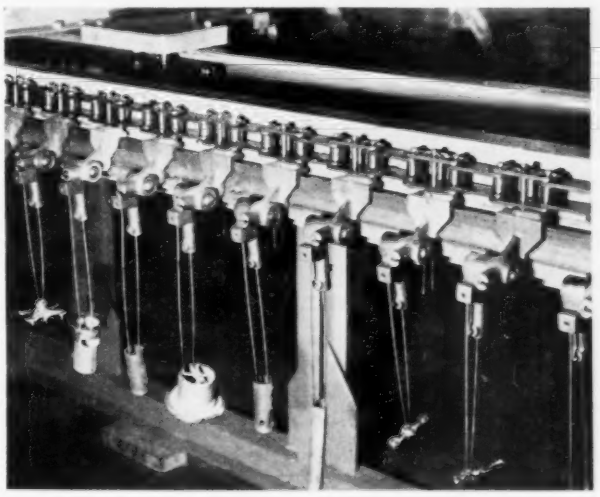
Static Elimination

The ability of dry films of graphite to conduct electricity enables such films to dissipate or "bleed off" static electricity from various pieces of equipment. Drive belts traveling at medium or high speeds, conveyors carrying volatile, flammable materials, journal bearings on industrial trucks and similar equipment frequently accumulate static charges of electricity which are potential hazards.

Probably the most important use for colloidal graphite in this field is the treatment of drive belts. Best results are obtained by using a dispersion of colloidal graphite in lactol spirits diluted with three parts of carbon tetrachloride. This diluted dispersion can be applied to the under or pulley side of drive belts with an ordinary brush. When the carrier evaporates an electrically conductive film is formed on the under side of the belt, that will continuously "bleed" static electricity to earth.

This conductive coating should be used on drive belts employing metal pulleys if it is to prove effective. A complete circuit from the under side of the belt, to the pulley, and from the pulley to the shaft can then be effected. It is then merely necessary to ground the shaft. This can be accomplished by using a carbon brush so mounted that it rubs on the shaft. The pigtail of the carbon brush is connected to a suitable ground such as a water pipe. A typical installation is illustrated in Figure 5.

The length of time that the colloidal graphite film will be effective depends in part on the extent to which the equipment is operated. To determine when the film must be restored, tests should be occasionally conducted. This can be done by bringing the end of the grounded wire close to the point where the drive belt leaves the pulley. If sparking or arcing is evident, a new application of graphite is required. It is obvious that this test should not be carried out when flammable or explosive materials are exposed or nearby. An electroscope, if available, may be used to detect the effectiveness of the graphite coating, without the inherent danger of a spark.



(*Photo courtesy Lasalco, Inc.*)

Figure 4. Contact shoes on automatic plating units, where the good conductivity and lubricating properties of graphite are required.

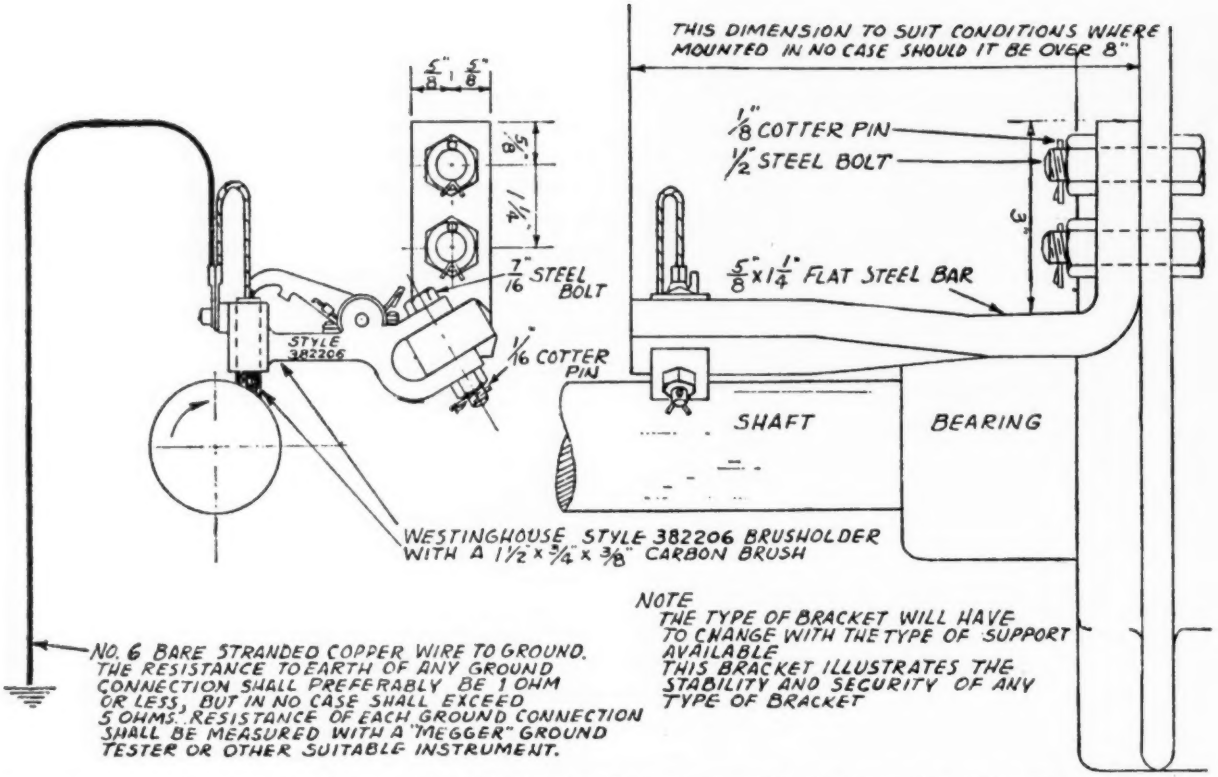

THIS DIMENSION TO SUIT CONDITIONS WHERE MOUNTED IN NO CASE SHOULD IT BE OVER 8"
1/8" COTTER PIN
1/2" STEEL BOLT
5/8" x 1 1/4" FLAT STEEL BAR
7/16" STEEL BOLT
1/16" COTTER PIN
STYLE 382206
SHAFT
BEARING
WESTINGHOUSE STYLE 382206 BRUSHOLDER WITH A 1 1/2" x 5/4" x 3/8" CARBON BRUSH
NOTE
THE TYPE OF BRACKET WILL HAVE TO CHANGE WITH THE TYPE OF SUPPORT AVAILABLE
THIS BRACKET ILLUSTRATES THE STABILITY AND SECURITY OF ANY TYPE OF BRACKET
NO. 6 BARE STRANDED COPPER WIRE TO GROUND. THE RESISTANCE TO EARTH OF ANY GROUND CONNECTION SHALL PREFERABLY BE 1 OHM OR LESS, BUT IN NO CASE SHALL EXCEED 5 OHMS. RESISTANCE OF EACH GROUND CONNECTION SHALL BE MEASURED WITH A "MEGGER" GROUND TESTER OR OTHER SUITABLE INSTRUMENT.

Figure 5. Diagram showing method for grounding static electricity from conveyor belts, thus preventing sparks and possible ignition of inflammable vapors.

Electroplating Non-conductors

Colloidal graphite offers many advantages in electroplating non-conductors. The electrical resistance of a graphite film is, of course, determined somewhat by the resistance of the graphite itself. However, by far the largest portion of this resistance is caused by the contact resistance between particles. Experiments have shown that the contact resistance is dependent to some extent on the particle size. It would seem logical that the larger particle size, and consequently fewer particles per given area, would give optimum conductivity. However, this is not the case, as large particles have poor film forming characteristics. Extremely fine particle size such as contained in water dispersions have the best film forming characteristics, but do not give the best conductivity.

Unfortunately, water dispersions of graphite require the addition of a binder to prevent removal of the graphite film when the object to be electroplated is immersed in the electrolyte. The presence of a binder increases the contact resistance, and therefore only the smallest amount necessary to accomplish the above should be added. The contact resistance of graphite films and films of a mixture of graphite and binder may be greatly reduced by baking at elevated temperatures. The electrical resistance is lowered in direct proportion to the increase in drying temperature and therefore, it is advisable to dry the films at the highest possible temperature, but not exceeding 350°C. Naturally, the nature of many of the materials to be electroplated will limit the temperature at which the graphite films can be baked.

A satisfactory formula for electroplating non-conductors may be prepared by adding a small percentage of suitable resin emulsion to a distilled water dispersion. When adding the resin emulsion it should first be diluted with distilled water and then slowly added with constant agitation. This is necessary to prevent flocculation of the graphite. Not all resin emulsions can be added to dispersions of colloidal graphite in this manner because a good many of them are not compatible. Before applying this dispersion to non-conductors, they must be thoroughly cleaned and degreased. Non-conductors that are porous must be water-proofed to prevent the electrolyte from seeping into the pores. After water proofing the non-conductors it is advisable to dry them at the same temperature at which the graphite film will eventually be dried, so that any shrinkage that is likely to take place will be accomplished before the dispersion is applied. There are many lacquers on the market that are suitable for water proofing porous materials such as leather, plaster, etc.

The mixture may be applied by brushing, spraying, or dipping. Surfaces that are not easily wetted by water or a water dispersion of colloidal graphite may provide some difficulty. When the surface is not very intricate this may be overcome by placing a few drops of the graphite dispersion on the surface with a swab of lintless cloth and smearing the liquid over the surface, followed by wiping off any superfluous moisture so as to leave only the thinnest possible film.

When this is dry the dispersion may be applied by one of the above methods without difficulty. When the surface is very intricate, and this method of overcoming wetting is not practical, good results are obtained by first applying a film of graphite with an

ethyl alcohol dispersion, which should be first diluted with 1 or 2 parts of alcohol, and applied to the object by brushing, spraying, or dipping. This dispersion of graphite thus applied will easily wet surfaces not wetted by a water dispersion and will dry very quickly. When it has dried, the water dispersion will then readily wet the surface.

When the film applied from the water dispersion is air dried, it should, if possible, be baked for about 15 minutes at a temperature of 110°C. or higher. This renders the graphite film relatively water proof and, as described above, improves the electrical conductivity. In cases where the material to be electroplated will not withstand such temperatures, it is necessary to use a lower baking temperature and also longer periods of time. Thus, a baking temperature of 65°C. requires approximately 4 hours and air drying at about 25°C. requires approximately 24 hours. After the graphite film has been thoroughly dried, it is ready for the plating bath. A standard acid copper bath is satisfactory. To prevent the plating from taking place in spots, it is essential that the initial contact be very good. This may be accomplished by winding several turns of bare, fine, copper wire around the object before connecting it to the cathode.

It is also important that the current density be very low at first; from 1½ to 2 amps. per square foot has been found suitable in most cases. As soon as the whole surface is covered with copper, contact may be made in a more normal manner and the current density increased. However, it is best to do the latter gradually rather than in one step.

On smooth plane surfaces, this dispersion does not have sufficient adhesion to be practical in most cases. It would be unreasonable to expect the adhesion of electro-deposited metal on a film of graphite to be equal to that where metal-to-metal contact has been established, since the resistance to shear cannot be greater than that offered by the graphite film itself. The most common cause of bad adhesion, other than using too high a current density in early stages of the deposit, is faulty wetting of the surface by the graphite dispersion. If the above precautions are taken in applying the dispersion, no difficulty should be encountered in the wetting. Where the non-conductors are irregularly shaped and an opportunity is offered for the plated metal to encircle the object, the adhesion is ample.

The lack of good adhesion between the electro-deposited metal and the graphite film is advantageous for electroforming. In electroforming, the procedure for applying and drying the film and subsequent electroplating are identical.

Stop-Off for Hot-Dip Tinning

A resin-naptha dispersion of graphite has been found successful for certain hot-dip tin plating operations where it is desirable to prevent the tin from adhering to certain areas. This dispersion contains an acid-resistant resin in addition to colloidal graphite, and the combination enables the dry film resulting from this dispersion to resist the action of hot hydrochloric acid and high temperatures. The graphite also prevents the adhesion of tin. Its use is confined to those applications where it is practical to heat the material to be tinned, and where the material is not flexed to any great extent during the process. These two limitations are necessary because the resin contained must be completely polymerized to be acid resistant, and complete polymerization can only be obtained by force drying the film. As the film of resin and graphite is somewhat brittle it can be flexed only to a limited extent without cracking. Cracking of the film will allow the pickling acid to work beneath the film and destroy its adhesion. A thin film may be flexed without cracking to a greater extent than a thick film, and therefore, it is advisable to apply only the amount necessary to attain complete coverage.

After the film of graphite and resin has air dried, it should be force dried at 300 to 450°F. for approximately 15 minutes. The drying temperature is not very critical, and lower temperatures may be used but longer periods of time should then be employed. After such force drying, the film will withstand the normal pickling, fluxing, and hot-tin dips, preventing the adhesion of the tin. If it is necessary to remove the remaining film, this can be done by shot blasting or by using commercial strippers.

Treatment of Plating Wastes

By E. G. Kominek, *Infilco, Inc., Chicago, Ill.*

ALTHOUGH the subject of stream pollution abatement has been a topic of widespread interest for many years, and although everybody seemed to talk about it, nothing much was done about it until the past few years. Common law decisions had established that every land owner is entitled to the use and enjoyment of streams without corruption, and that a riparian owner has no right to pollute the waters of a stream. Many states had statutes as early as 1905 which prohibited stream pollution. However, enforcement has been ineffective in most cases, and with the rapid growth of industry the conditions of the streams has gone from bad to worse. Today, many of our major rivers which drain through industrial areas can literally be classed as open sewers.

Legal Aspects

The pressure of public opinion to alleviate this condition finally led to the passage of Public Law 845, the Federal Water Pollution Control Act, which was approved on June 30, 1948. The purpose of the law is "*To provide for water pollution control activities in the Public Health Service of the Federal Security Agency, and for other purposes.*" The law does not "crack down" on municipalities or on industry, and it does not affect the State's jurisdiction over the control of their waterways. However, this law has encouraged the enactment of Inter-State Compacts to provide the co-ordinated activities by the State Agencies for cleaning up the various watersheds, and thus has provided an added stimulus for abating the nuisances caused by the discharge of raw sewage and of industrial wastes into the rivers. An example of this type of agreement is the Ohio River Valley Water Sanitation Compact which was signed by the governors of the States of Indiana, West Virginia, Ohio, New York, Illinois, Kentucky, Pennsylvania and Virginia on June 30, 1948. This compact covers a drainage basin of 203,900 square miles.

Each state has pledged to enact the necessary legislation to maintain the waters of this basin in a satisfactory condition for use as public and industrial water supplies, after reasonable treatment, suitable for recreational usage, capable of maintaining fish and other aquatic life, and free from unsightly or malodorous nuisances. A commission has been created to study the pollution problems in the district and to present its recommendations to the states. The commission is empowered to issue orders to any municipality or corporation specifying a date on or before which the discharge of untreated wastes must be discontinued, and is further authorized to institute court action for the enforcement of such orders. Similar compacts are in effect to cover most of the major drainage basins in the East.

What effect will legislation of this type have upon plating plants? It depends largely upon their location. Plants which discharge directly into rivers or lakes can expect action within the next few years. In Pennsylvania and Virginia most industrial plants have already been ordered to prepare plans for the treatment of their wastes. Plants which are located in municipal areas, and which discharge their wastes into city sewers, may not be required to treat their wastes until municipal treatment facilities are installed, and then the treatment required will depend upon the volume of wastes relative to the volume of sewage, and on the type of treatment employed. In some cases, as in Bridgeport, Connecticut, consideration is being given to the installation of a treating plant which will handle large quantities of plating wastes.

In large cities, it is likely that the small plating plants will not be required to do more than neutralize the free acids present in their wastes. However, in the smaller communities, the need for fairly complete removal of copper and other toxic metals and of cyanides, can be anticipated because these compounds even in relatively low concentrations affect the biological treatment of sewage. Most cities have an absolute control over the wastes discharged into their

Figure 1. Battery of dry chemical feeders for neutralizing wastes with lime slurries.

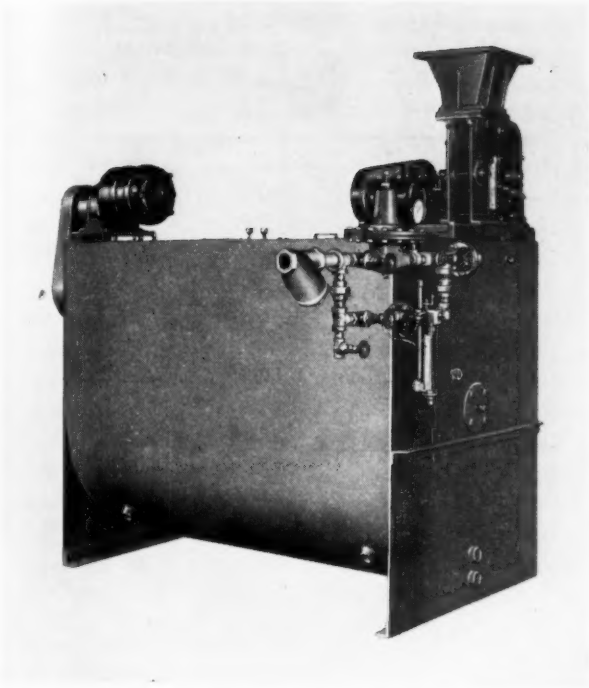


Figure 2. A machine for automatically slaking lime for neutralization purposes.

sewers, and therefore can limit the direct disposal of toxic substances.

What to Do About Waste Disposal

In the event that state or municipal authorities require reduction of trade wastes discharge, there are several steps which can be taken which may alleviate the need for complete or even partial treatment. The most important consideration in this regard is improved housekeeping, which can save money not only because of the reduction in trade wastes, but also in the conservation of valuable solutions. The periodic inspection of all piping and tank connections to eliminate leaks should be a routine maintenance assignment. The treated work should be held over the treating tanks for as long a time as possible to minimize drag out, and care should be taken to maintain the proper level in the plating tanks and to prevent splashing when the work is introduced. Any improvements which can be made along these lines will save money, particularly if the reduction in contamination will produce rinse waters which are sufficiently low in objectionable substances to be acceptable for disposal without treatment.

In most cases the assignment of responsibility for waste disposal control to a chemist or to a plant engineer will be essential. In a large plant, this can profitably be a full time job, at least until a definite program for handling the wastes can be established. As an alternative, a consulting engineer should be engaged to conduct an investigation to determine the volume of wastes being discharged and the concentration of the objectionable substances. A study of this type will usually indicate that excessive amounts of water are being used, and that with minor modifications of the system both the volume and concentration of the wastes can be reduced.

It will also be essential to conduct an educational campaign in the plant so that the foreman and workers will discontinue the practice of "getting rid" of various solutions by dumping them down the drain. In a large plant, the installation of meters in the various sewer lines, combined with a closely controlled system of "waste accounting" with the establishment of waste standards, may be necessary so that management can be kept aware of deviations from the standards which have been set up, the same as in any other important manufacturing operation.

Whenever possible, the dumping of plating solutions should be avoided. The installation of filter presses or of diatomite filters to remove sediment or precipitated impurities is a worthwhile investment, because of the value of the recovered solutions, and because of the saving in the costs of treatment of the wastes. Every gallon of solution dumped results in three charges to the plater: (1) Cost of chemicals for make up of solutions; (2) Costs of chemicals for treatment of the spent solution, and (3) Cost of sludge disposal.

If a plant is located on a large river, or in a large municipality, the segregation of strong solutions may permit their discharge at a low rate of flow over a long period, together with the rinse waters. If the strong wastes cannot be tolerated even under these circumstances, their segregation for batch treatment may preclude the need for treatment of the larger volumes of rinse water, which would involve greater expenditures for equipment, because within limits, a treating plant must be designed on the basis of the volume of wastes to be treated, and on the settling rate of the solids to be removed, regardless of the quantity of solids present in the waste.

If treatment of the rinse waters is needed, the installation of equipment will be more elaborate and more expensive. Provisions will have to be made to segregate cyanide wastes from acidic wastes to prevent liberation of hydrocyanic acid; chromates may have to be segregated for reduction; in cases where it is necessary to remove much oil from the work, the oil bearing detergents may have to be segregated for controlled blending with the metallic wastes to permit coagulation and absorption of the oil by the metallic hydroxides which are precipitated. In some instances, where the requirements for treatment are very critical, clarification alone will not produce an acceptable effluent because the carry over of a few parts per million of suspended solids, which may consist largely of chromium or copper hydroxide, may exceed the limits which were established by the State or Municipal authorities.

Neutralization of Acidic Wastes

The disposal of acidic wastes will be most frequently encountered in plating plants except in cases where the volume discharged has only a very slight effect upon the pH in the sewers. In some cases, where tanks of acid or of acid salts are periodically dumped, the need for treatment can be avoided by storing the wastes, and discharging them into the sewer at a low

Table I. Cost Comparison of Various Alkaline Agents

	Grade	Container	Carload Price/Ton	Cost/Ton Basicity xx
Sodium Hydroxide	Flake 76%	Drum	$58.00	$84.42
Sodium Hydroxide	Dense 56%	Bag	25.00	50.49
Ammonia	Aqua 35%	Drum	60.00*	36.44
Ammonia	Anhydrous	Tank Car	59.00	35.82
Magnesium oxide	Powder	Bag	60.00	45.94
High Calcium hydrate	Chemical	Bag	11.00	15.49
Dolomitic hydrate	Chemical	Bag	11.00	12.00
Dolomitic hydrate	Pressure	Bag	13.00	15.85
High calcium quicklime	Pulverized	Bag	12.00	12.75
High calcium quicklime	Pulverized	Bulk	9.50	10.10
Dolomitic quicklime	Ground	Bag	12.00	10.81
Dolomitic quicklime	Ground	Bulk	9.50	8.56
High Calcium limestone	Pulverized	Bag	4.00	8.18
High Calcium limestone	Pulverized	Bulk	3.00	6.13
Dolomitic limestone	Pulverized	Bag	4.00	7.09
Dolomitic limestone	Pulverized	Bulk	3.00	5.32

* Price per Ton NH_3 as aqua ammonia.
xx Basicity equals cost per ton of calcium oxide equivalents for each agent.

rate of flow so that they will be neutralized by the usual alkalinity of the sewer water.

However, except in the case of small plating plants in large municipalities, it is likely that acid neutralization will be a requirement. Acid or acid salts can be neutralized with any alkali, although lime or limestone are most commonly used because of the lower cost.

Hoak and Lewis[5] have investigated the use of various alkalis for the neutralization of waste pickling acid, and have tabulated their relative cost and neutralizing power as shown in Table I.

Gehm[3] and *Reidl*[8] have described treating plants where acidic wastes were passed up-flow through beds of crushed limestone for neutralization. Gehm concluded that a flow rate of 20 to 100 g.p.m. per sq. ft. could be used, with bed depths of 1 to 4 ft., provided that the sulfuric acid concentration does not exceed 5000 p.p.m. and provided that appreciable quantities of metallic salts are not present. Reidl recommended a flow rate of 40 to 50 g.p.m. per sq. ft. through a 18" to 24" bed to allow for liberation of carbon dioxide formed as a result of the neutralization and to flush out any precipitated metallic salts. This treatment will increase the pH to about 5.0, and therefore will prevent any appreciable corrosion of the sewer lines. However, as sulfuric acid and sulfate salts are most commonly used in plating plants, and as metallic salts are usually present, calcium sulfate or metallic hydroxide deposition on the limestone have favored the use of high calcium lime for the neutralization of waste plating solutions.

For small plants using less than about two tons of lime per day, the installation of a dry feeder affords the simplest solution. Figure I illustrates a battery of feeders with storage hoppers and mixing tanks, the lime slurry being pumped from the mixing tanks shown to the point of application. However, where larger quantities are used, the purchase of quicklime and the installation of a lime slaker will be more economical because, as indicated in Table I, the cost can be reduced from about $15.49 to $10.00 per ton of quicklime. Figure II illustrates a typical lime feeder and slaker. Pebble quicklime and water are fed at a controlled rate into the slaking compartment where they are mixed for a sufficient time to uniformly slake the lime, a hydrated lime slurry being discharged through the outlet.

Neutralization proceeds almost instantaneously, except if the sulfate concentration is sufficiently high to deposit calcium sulfate on the lime particles. A mixing tank having a detention time of about 5 minutes will produce a neutralized effluent provided that an agitator which turns over the tank contents about twice per minute is installed. The lime feeder or the feeder and slaker can be arranged for manual control, flow proportioning control or for pH control. The latter method will afford the greatest economies in lime, and will produce a uniformly neutralized effluent, and will maintain a record of the results as a protection to the plant against possible litigation for damage to sewer lines.

In smaller plants, the installation of a constant rate feeder, set for a dosage somewhat in excess of the average, will afford satisfactory results at a lesser cost for equipment, provided that strong acid tanks are dumped at scheduled intervals, with the lime dosage being increased when the strong solutions are dumped. If possible, the dumping of tanks should be scheduled when the plant is not in operation, as at the end of a shift, or on a Saturday or Sunday, to prevent the possibility of their discharge without neutralization.

Removal of Metallic Salts

The neutralization of acids to a pH of about 7.0 will not precipitate most of the metallic salts present

in plating wastes. Hence if plating plants are required to remove toxic metals such as copper, nickel, zinc or iron, the neutralization must be adjusted to increase the pH to the range of 8.5 to 9.0 to precipitate these metals as the hydroxides. The presence of copper in the effluent is the most objectionable because of its toxic effect on aquatic life or on the biological growths which digest domestic sewage, and many authorities insist upon essentially complete copper removal. Although the residual solubility of copper is only about 0.09 p.p.m. at a pH of 8.1, it is desirable to adjust the treatment to a pH of at least 8.5 to compensate for fluctuations in the composition of the waste, or in rate of chemical application.

Chromium is also toxic, and must be removed. However, as the hexavalent chromium cannot be economically precipitated, it is necsesary to reduce the chromium to the trivalent form so that it can be precipitated as the hydroxide. *Hoover and Masselli*[6] investigated the efficiency and costs of various reducing agents, as shown in Table II.

Table II. Treatment of 100 p.p.m. Chromium Waste Solutions

Reagent	H_2SO_4 Lbs./ 1000 gal.	H_2SO_4 lbs./ 1000 gal.	pH End Reaction	Lime lbs./ 1000 gal.	Sludge % in 2 hours	Chem. Cost Cents/ 1000 gal.
Liquid	4	..	2.5	6	16	26
$NaHSO_3$	4	..	2.0	3.5	14	20
Na_2SO_3	4	2	2.5	5	11	28
Na_2S	2	..	8.0	2	16	9
BaS	4	..	5.0	2	8	16
Copperas	12	..	3.5	7	22	19
Iron Scrap	3	3	2.5	5	15	11
Zinc	3	3	3.7	6	17	31.5
$Pb(Ac)_2$	7	..	2.8	5	2	86
$Ba(OH)_2 \cdot 8H_2O$	8	..	10.0	..	5	56

If waste pickling acid containing ferrous sulfate is available, this can be used as the reducing agent at no additional cost, as treatment of the pickling liquor would probably be required prior to disposal anyway. This necessitates segregation of the pickling liquor for blending with the chromate wastes in a mixing tank prior to combination with the other wastes for treatment with lime. Approximately 3.22 p.p.m. of ferrous iron are required per p.p.m. of chromium, as shown in the following reactions:

$$2Na_2CrO_4 + 6FeSO_4 + 8H_2SO_4 \rightarrow$$
$$3Fe_2(SO_4)_3 + Cr_2(SO_4)_3 + 2Na_2SO_4 + 8H_2O$$

Scrap iron is also effective if it is available, but it is necessary to reduce the pH 2.0 to prevent the iron from becoming coated with ferric oxide which interferes with the reduction. However, both of these methods have the disadvantage of dissolving iron which must subsequently be precipitated, thereby adding to the volume of sludge which must be disposed of. Sodium sulfide is an effective reducing agent, but the waste must then be treated for removal of the residual sulfides, and the waste is difficult to clarify because of the presence of residual sulfur compounds.

In consequence, if pickling liquor is not available, the use of sodium bisulfite offers a convenient method of treatment. Sodium bisulfite is an effective reducing agent if the pH of the waste is approximately 2.2 or less, according to the following reaction:

$$3NaHSO_3 + 2Na_2CrO_4 + 5H_2SO_4 \rightarrow$$
$$Cr_2(SO_4)_3 + 2Na_2SO_4 + 3NaHSO_4 + 5H_2O$$

The reduction is completed in a few minutes and the subsequent addition of an alkali precipitates chromium hydroxide.

Disposal of Cyanides

Cyanides are exceedingly toxic, and therefore must be removed completely, or reduced to a very low concentration prior to disposal. *Dobson*[2] has reported on the current opinions regarding cyanide concentration, and the consensus indicates that no more than a "trace" can be present, as a concentration of 0.1 p.p.m. is toxic to fish and other aquatic life. In fact, although cyanates are much less toxic than cyanides, in some cases even the presence of cyanates will not be tolerated when the wastes are discharged into a potable water supply. There does not appear to be any agreement as to the concentration of cyanide which can be discharged into municipal sewers, but a maximum concentration of about 1 p.p.m. in the sewer will usually be tolerated, which means that direct disposal of the rinse waters may be permitted, providing of course that no acids are discharged at the same time.

Removal of cyanides by acidification to hydrocyanic acid which is subsequently removed by aeration is employed in some cases, and has been described by *Oeming*[7] and *Herda*.[4] The cyanide bearing wastes are segregated in batch tanks to which sulfuric acid is added to reduce the pH to about 3.0, after which the solution is aerated vigorously for several hours, with the gases being dissipated at a low concentration through a tall fume stack. This method will reduce the cyanide concentration to about 1 p.p.m. in the waste liquor, but the method would appear to be applicable only in rural areas for the treatment of wastes which have a large concentration of cyanides. In cases where this treatment is used, the acid waste must then be neutralized and the metallic salts precipitated and removed by sedimentation.

Treatment of cyanides by chlorination has been discussed by *Dobson*.[1] Cyanide is oxidized in two stages:

$$NaCn + 2NaOH + Cl_2 \rightarrow NaCNO + 2NaCl + H_2O$$
$$2NaCNO + 4NaOH + 3Cl_2 \rightarrow$$
$$2CO_2 + 6NaCl + N_2 + 2H_2O$$

These reactions are carried out at a pH of 8.5 to 8.6. Lime can be used for pH adjustment instead of the sodium hydroxide shown in the above reactions. Theoretically, 2.73 parts of chlorine and 3.08 parts of caustic or 2.85 parts of lime are needed to oxidize cyanide to cyanate, or 6.82 parts of chlorine and 6.16 parts of caustic or 5.71 parts of lime to oxidize cyanide to nitrogen and carbon dioxide. In practice, however, about 4 parts of chlorine are used for the partial treatment, and 8 parts for the complete oxidation. As the waste liquors will contain metallic cyanides or

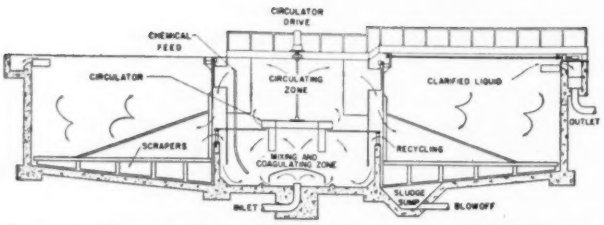


Figure 3. Diagram of a continuous sludge separator for treating plating wastes.

cyanide complexes, the oxidation at a pH of 8.5 will result in precipitation of most of the metals in a semi-colloidal form which cannot be effectively removed by sedimentation unless they are properly coagulated. As many plants will have spent pickling liquors, acidic rinse waters, and alkaline detergents as well as cyanides for disposal, consideration should be given to the blending of the cyanide wastes with the other plant wastes for final clarification after the cyanides have been destroyed.

Types of Treatment

If waste treatment is required, the size and cost of the installation are primary considerations. *In some cases the size may be of even more importance than cost because of the crowded facilities in a plant, although in many cases the smaller size goes together with lower installed cost. For the small plant, batch treatment equipment will be the cheapest to install, particularly if the plant operates only one shift per day. The installation of tanks for receiving the wastes, and the purchase of a portable agitator for mixing the tank contents and a scale for weighing the chemicals will permit operations on a "fill-and-draw" basis. The tank contents can be analysed by the plant chemist and the quantity of chemicals computed so that the tank can be treated before the end of the shift, and the sludge can settle out over night and permit the clarified water to be drained to the sewer after a check analysis in the morning.

However, if the plant operates continuously, or if the volume of wastes is categorically in excess of 10,000 gallons per day, continuous treatment is usually more economical. As an illustration, 4—12′0″ diameter by 14′0″ depth tanks were installed to treat a maximum of 10,000 gallons per day of a waste chromate solution by batch methods, whereas this same amount could have been treated equally effectively in a 10′0″ by 10′3″ depth continuous treating machine which employed the optimum conditions of mixing and sludge recirculation. In another instance involving the treatment of about 80,000 gallons per day, a 40′0″ diameter by 16′0″ depth continuous unit will be used instead of 4—14 ft. diameter mixing tanks followed by a 64 ft. by 100 ft. by 10 ft. depth settling pond for a batch treatment process.

If continuous treatment is employed, the composition of the raw wastes must be reasonably well equalized so that the treatment can be kept in balance. For this reason, equalization basins should be installed to maintain a reasonably uniform composition in the waste to be treated. This is of particular importance if the reduction of chromates or if the oxidation of cyanides is involved. In any reactions involving the precipitation of metallic hydroxides, pH controlled feeders can be used to maintain the desired pH in the treated waste, and equalization of composition is of leser importance.

When metallic hydroxides are precipitated, the conditions of mixing and of chemical addition have an important bearing on the type of sludge which is produced. Most metallic hydroxides come down as light, fragile floc particles. In batch treatment, when relatively large quantities of chemicals are added to a large volume of water, the conditions of mixing will usually result in the formation of very small floc particles because of the localized over treatment, and because of the deflocculating action of the mixing equipment.

This condition is avoided to a large extent in continuous equipment particularly if provisions are made for recirculating previously precipitated slurry into the reaction compartment of the treatment equipment to obtain the benefits of precipitation on the existing particles.

An example of a continuous unit used for treating plating wastes is shown in Figure III. The central section consists of concentric tubes with the incoming waste and treating chemicals being mixed by means of a rotor in the basal section of the inner tube. The rotor also serves as a low lift pump, pumping 3 to 4 times the throughput up the inner tube and developing sufficient head to circulate the slurry out into the annular zone where the larger and denser floc particles settle out. The clarified water separates from the circulating slurry and discharges over a weir into a launder. The volume circulated is in excess of the amount of clarified water which overflows the weir and slurry is therefore pumped back into the central mixing zone and mixed with the incoming water and chemicals.

The beneficial effects of slurry recirculation in producing a more compact sludge can be readily demonstrated. For example, if a waste containing chromic acid equivalent to 42 p.p.m. of chromium is treated

Figure 4. Waste treatment plant at the Sandusky, Ohio plant of New Departure Corp.

with bisulfite and then with lime, a sludge volume of 15% is obtained after 10 minutes settling. If the clarified water is decanted from the sludge, and the sludge is returned to another volume of the waste after it has been reduced with bisulfite, a sludge volume of about 22% will be obtained in the second test, or an average of 11% per volume. If this process is continued until 3 volumes of sludge are returned, the sludge volume in the last test will be about 28%, or 7% per volume of waste treated. This is a reduction of about 53% due to the compacting effect of the returned sludge. The same compacting effect can be demonstrated with other metallic hydroxides.

If plating wastes alone are being treated, an effluent water having an average turbidity of less than 10 p.p.m. will usually be obtained. However, if the plant is engaged in machining operations, the disposal of waste cutting-oil emulsions may complicate the problem of treatment. Precipitated hydroxides are effective oil adsorbents, but if the quantity of oil is excessive provisions should be made to equip the clarifier mechanism with a hydraulic skimmer so that the free oil can be continuously removed from the surface. If the concentration of oil is very high, two stage treatment may be required, with acid or a coagulant being used to break the oil emulsion in a primary unit, so that the bulk of the oil can be removed prior to blending of the partially clarified oil-bearing wastes with the plating wastes for final treatment. *Unwin*[9] has described the operation of a plant of this type at the New Departure Division at Sandusky, Ohio, where a final effluent containing an average of about 10 p.p.m. of oil and less than 0.2 p.p.m. of chromium is being discharged, in spite of the fact that the oil content of the raw wastes during initial operations was as high as 110,000 p.p.m., and the chromium content ranged up to 189 p.p.m. Figure IV illustrates the primary Clarifier and the Cyclator.

The effluent obtained from a properly operated waste treatment plant will satisfy the state or local authorities in most instances. However, if copper or chrome wastes alone are being treated, and if the effluent discharges into a water supply which has a limited flow, the requirements for treatment may necessitate filtration of the clarified water to remove the small amount of suspended metallic hydroxides. For example, the State of New York is requiring that the chromium content of treated wastes shall not exceed 0.05 p.p.m. in some instances. This makes final filtration a "must." Sand filters of the pressure or gravity type can be used for this purpose, operating at a rate of 2.0 to 3.0 g.p.m. per sq. ft. as in the case of the treatment of an industrial water supply. If filters are installed, the piping must be arranged to return the backwash water to the clarification unit, or to a storage tank, so that the solids removed from the filter will not be discharged from the plant.

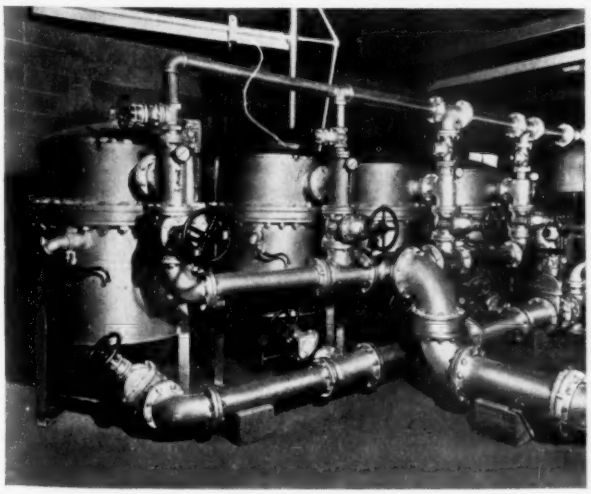


Figure 5. A battery of filters for separating sludge from the treated wastes. This type of filter is cleaned by backwashing.

Sludge Disposal

Unfortunately, the job of waste treatment is not completed even when a properly treated effluent is discharged from the plant, as all of the contaminants remain in the form of a fluid amorphous sludge having a solids content of 1% to 5% by weight, and some means must be provided for disposing of this sludge. The sludge filters very slowly on vacuum filters, forming a thin, slimy cake which tends to clog the filter unless a large amount of diatomaceous earth is added. In one instance, a vacuum filter maunfacturer recommended adding 5% by weight of diaotmite to an iron and chromium hydroxide sludge prior to filtration, at an estimated cost of about $20.00 per 1000 gallons of sludge. Filter presses are somewhat more effective but as the sludge clogs the filter cloths, filter runs are short, and the labor required for operation is high.

The use of centrifuges has been investigated, but they are not effective because the specific gravity of the solids in the sludge is low, and because the action of the centrifuge tends to break up the sludge particles so that the water which is separated must be returned to the system for re-clarification. The sludge dries slowly on sand beds, and therefore lagooning appears to be the most satisfactory (or the least unsatisfactory) method to employ.

Sludge disposal by lagooning is impractical in most municipal areas, however, because of the space required, and provisions must frequently be made to have the sludge moved to some disposal point. This can be an expensive operation, particularly if the volume is large, and it is therefore advisable to hold the sludge in tanks or in mechanical thickeners so that as much water as possible can be separated by decantation. In most cases, a sludge containing 4 to 5% by weight of dry solids can be obtained by this method.

By-Product Recovery

It is frequently asked whether a waste treatment plant can be operated to permit the recovery of by-products to defray the costs of treatment. If a plant carrys on extensive machining operations the recovery of oil may be profitable, particularly at the current prices of oil. In one instance, the recovery of 3000 gallons of oil per week from a large treatment plant

defrayed essentially all of the operation costs, including chemicals and operators wages.

Copper and other heavy metals can be deposited from slightly acid solutions by contact with scrap iron or steel, and chromium can be precipitated with soda ash or caustic soda for the recovery of chromium trioxide. The use of ion exchangers for the recovery of heavy metals from waste solutions is also being investigated. *Bloodgood* at Purdue, and *Bliss* at Yale are both working on this problem.

If a new plant were being designed with the object of recovering by-products, it might be possible to obtain the recovered product in a reasonably pure form. Unfortunately, most plants were not laid out with this objective in mind, and when it is necessary to treat the mixture of wastes in the outfall sewer, which may even contain sanitary sewage, it is virtually impossible to recover by-products in a salable form. If provisions are made to segregate the wastes, as is required in many cases, there would nevertheless be a considerably larger capital expenditure for recovery equipment, as pre-treatment of the wastes might be required to permit precipitation of the metals in a reasonably pure form, after which the sludge would have to be filtered, washed, and probably dried. The quantity of by-product involved would have to be very large to justify the expense of installing and operating the recovery equipment.

Ion exchange offers the most promise along these lines, as the units are relatively small, and could be installed in the plant adjacent to the plating tanks to treat the clean, uncontaminated rinse waters. This method affords the advantage of concentrating the metals recovered when the exchanger is regenerated, and also permits recovery of a demineralized water which can be recirculated through the plant. This will be particularly beneficial in localities where water rates and sewer charges are high, or in cases where the raw water quality is poor so that treatment of process water is necessary or at least desirable.

However, the installation of ion exchangers for treating mixed wastes would be impractical, because the exchange resins would rapidly become fouled by any oil or suspended solids present in the waste, and as the metals recovered in the spent regenerating solution would be contaminated with other cations present in the water, they would probably be of little value.

In consequence, the plater faced with the immediate need for waste treatment in an existing plant should reconcile himself to the fact that waste treatment is another operating expense which must be added to the "Cost of Goods Sold," and considered in establishing the selling price of the product.

The cost of waste treatment will probably range from about 10 to 30 cents per thousand gallons, depending on the nature of the wastes, and if a system of efficient water and chemical utilization is maintained in the plant it will be found, in most cases, that the addition to the unit costs of the product will not be very great.

Conclusions

The growing shortage of ground water supplies in the United States is forcing more industries and cities to treat river waters for industrial use and for municipal supply, and as public opinion has been aroused in favor of cleaning up the streams, the program will probably continue. It is fortunate that the pollution abatement program will be co-ordinated by the Federal law, as this will mean that all industry, regardless of their location, will have the same problems and essentially the same expenses, and it is unlikely that many plants will have a competitive advantage by being able to discharge untreated wastes for any length of time.

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CORRECTION

It has been brought to our attention that a statement in the article by Mr. Rick Mansell "Electrodeposited Zinc Coatings" (*Metal Finishing*, Dec. 1948, p. 63) to the effect that ".0004" of zinc is preferable to double this thickness of nickel as an outdoor decorative finish, if both are chromium plated" is in error of the facts, as reported in Research Papers RP712 and RP1293 of the National Bureau of Standards. The author and editors regret this error and are grateful for having had this mis-statement called to our attention.

Reducing Finishing Costs Through Modern Techniques

By Dr. S. Wernick, *Consulting Electrometallurgist, London, Eng.*

IT IS surprising what comparatively little attention mechanical polishing processes have received at the hands of technicians in the metal finishing industry. When one examines the literature, for every paper or reference to metal polishing there are literally fifty to a hundred references to electrodeposition processes. This is somewhat strange when we consider the great importance of polishing in the production of industrial metal finishes, particularly chromium plating, which is the most popular of all. Technical progress is continuously occurring in the plating shop, but progress in polishing is mainly left to organizations which are interested in producing polishing machines.

Finish Standard

There is one very important consideration which cannot be stressed too highly, and that is the standard of finish which is required. It may be said that a buffed finish is one which results in the highest degree of lustre, or, to put it another way, possesses the highest reflectivity possible.

In the past, it has been customary to stress the importance of producing high standards of finish aiming as far as possible at mirror brightness. Polishing of this order is not unusual and one of the biggest difficulties which confronts the technician in dealing with the problem of reducing polishing costs is the fact that he is still usually expected to produce an equivalent finish to that which has become very widely established as being standard. Now the appearance of a finish has to be judged by the artistic eye, and æsthetic tastes obviously vary. There are some who may think that a highly polished chromium plated surface is a thing of beauty and there are others who may think that too much of this bold and unsympathetic color winking at one in the sunlight is garish, to say the least. Very largely, however, it is a question of the customer's choice in the matter, and the customer can always be educated. If, for example, it would be possible to reduce finishing costs very considerably by producing a finish which is not of such a high lustre standard as that to which we are normally accustomed, then it might be worth a certain amount of campaigning to create a favorable market for such a finish. There is a very good analogy in the field of organic finishes—there crackle and wrinkle finishes have been introduced, which are undoubtedly attractive and which have the very useful attribute that they cover up a multitude of defects on the surface of the basis metal. In the same way it should be possible to produce more substitute finishes of the satin type or even of the matte and semi-matte type, which in the right surroundings should prove no less attractive than the normal buffed chrome finish.

However, æsthetic considerations undoubtedly enter here, and while it would be entirely justifiable to reduce the quality of polish on certain articles, it would not be desirable on others. For example, there is a very good case for reducing standards of polish on certain automobile components, whereas obviously one could not do this with impunity in dealing with table ware. Each case has to be considered on its merits, and one of the important points is just how far the particular article or component is normally away from the eye of the observer when in service. Obviously, an article such as a furniture fitting or a bumper bar of a car, which is normally at least six feet away from one's eye, ought not to be finished so highly that it requires examination at ten inches distance under a powerful lamp to discover superficial defects.

The Author

Dr. Wernick is one of the world's outstanding electrometallurgists. He has been very active in the field of electropolishing and bright plating, and his book on these subjects was published recently. He is at present Secretary of the Electrodepositors Technical Society, having served as its President for several years, and has a wide knowledge of electroplating and finishing practice in both this country and his own native England.

Automatic Polishing

Considerable progress has been made in the design and production of automatic polishing machines. Obviously such machines are not universally applicable, since while they have been designed on increasingly adaptable lines so that they can cope with components of reasonable variation and shape, they are in the main suitable for dealing with fairly considerable runs of components of the same type and shape. They are, therefore, not advocated for the majority of contract metal finishing organizations, in spite of their wide use in other types of establishments.

It is possible to produce an adequate polish uniformly over the surface of articles of not too complex shape by using automatic machines.

Two types of automatic polishing machine are particularly popular:

(1) ROTARY-TABLE TYPE MACHINE, whereby the components are set up on the periphery of a table and in rotating come under different polishing heads, while at the same time they may themselves either be stationary or be turned progressively so that different parts of the component are polished as they rotate.

(2) STRAIGHT-LINE TYPE MACHINES—so called because a series of polishing heads follow one another consecutively in a straight line and engage the piece part which travels on a conveyor from one end of the line to the other. The polishing heads are dressed with emery or other abrasive, the fineness of which increases as the piece part travels towards the final polishing head. This type of machine is obviously more applicable to long and comparatively narrow components which normally would be polished along the surface rather than laterally.

Automatic polishing machines have to be adapted according to the class of component which they are required to polish. The design of such machines is a specialized business which requires considerable training and experience. Nevertheless, in the case of components of special shape, the problem has occasionally been tackled by engineers inside works' organizations, who have as a result of skill, ingenuity and patience produced a machine especially applicable to the product concerned. Where production is on a large scale, such development work is called for and eminently worth while. The special arrangement of polishing heads which are placed at strategic angles in the path of the component requires careful study, while the production of suitable holding jigs which place the piece part in the most favorable position for receiving an adequate degree of polish is also highly important.

Not all objects, however, lend themselves to automatic polishing treatment, and where the number of components is few or there is considerable variation in the type of product to be polished, then manual polishing must be resorted to. Nevertheless, there is often very considerable room for improvement in the polish attainable in a given time, since polishing operatives vary very considerably among themselves with respect to personal idiosyncrasies in tackling a given polishing job. Bad polishing habits can easily be formed which are difficult to eradicate, and training in the early stages of a polisher's career is of the highest importance. Another important aid to economical polishing, particularly in tackling heavy components, is the use of special holding tools which enable the polisher to handle the component with the smallest degree of fatigue and the greatest degree of engagement with the polishing wheel. With heavy components, it may be desirable to have an adaptable and flexible stand facing the wheel on which the article can be placed and maneuvered with much greater ease by the polisher than if he had to carry its full weight throughout the period of polishing.

Barrel Polishing

In any consideration of economies in polishing, the methods represented by the use of the barrel should have an obvious place. This is, however, a very wide topic, the various aspects of which could easily take up a whole paper in itself, and it is not proposed to deal with this development here.

As is well known, very considerable economies both in material and labor have been effected by the use of barrel polishing equipment. It is particularly valuable where the following factors prevail:

(1) Adequate space for setting up a series of barrels.

(2) A fair time element, since barrelling may take anything up to several days to achieve the desired degree of polish.

(3) Components of the correct shape which lend themselves to such processing, e.g., of the smaller type and containing corners or protuberances which are not too sharp and which would otherwise be rounded.

Influence of the Basis Metal

The polisher is very much dependent upon the condition of the base metal which is passed to him for treatment. This aspect cannot be too strongly stressed, and obviously necessitates close cooperation between the metal suppliers and the polishing department wherever this can be effected.

In the case of pressed articles manufactured from steel or brass, freedom from spills, pits, oxide inclusions, etc., are conditions which must be very carefully watched. In effect, it is the "cleanness" of the surface which has become a very important factor in reducing costs.

One of the most important points to watch in an endeavor to reduce polishing costs, therefore, is the initial condition of the base metal which is to be polished. Particularly does this apply to steel surfaces. A piece of steel which comes into the factory in a highly scaled state will necessarily require heavy pickling in order to remove the scale. Even with inhibitors of the best type it will often be found that the resultant surface is distinctly uneven, as the scale itself is not usually uniform in thickness. The result is that a pock-marked condition is produced on the base metal which can only be brought up to the requisite degree of polish when the deepest of these

marks has been eradicated (the process known as "bottoming" by polishers).

Modern steel fabricating practice is tending towards the elimination whenever possible of heat treatment, which causes scale formation and consequently increases the difficulties and cost of polishing. It is possible to obtain cold rolled high tensile steels which are free from scale and surface defects of the kind described and which present a greatly improved surface for polishing. Such raw material is necessarily more costly, but a case may be made out in numerous instances where the apparent extravagance in buying raw material of a superior class is fully warranted, because it is more than offset by the reduction in polishing costs which results. It may be said, of course, that under present conditions when shortages are such that manufacturers are glad to receive almost any quality of steel that there is hardly any choice available. Nevertheless, this is not quite the case even today and producers of components on any scale are advised to investigate the position with their steel suppliers to see what can be done.

With respect to castings, the greater the attention that is given to the production of a good sound casting free from porosity and exfoliation, the greater will be the chances of eliminating steps in the polishing sequence in producing a bright chrome finish. The possibility of producing a successive deposit of copper, bright nickel and chrome on a zinc base die-casting without wheel operations at any stage has received some investigation, and it is clear that with the close cooperation of the die-casters, such a sequence is not outside the bounds of practicability; difficulties, of course, come in through the necessity to trim the casting free from flash, etc., and the necessity to tone down the polishing marks which may result through the trimming operation.

Bright Plating

Assuming that all that can possibly be done in order to reduce the initial cost of polishing has been fully investigated, the next point to consider is how much saving can be effected in finishing operations subsequent to the production of the electro-deposit. The largest economy which has been achieved in this field has resulted through the introduction of bright plating of metals, in general, and bright nickel plating in particular. The objective obviously is to produce a nickel electro-deposit which requires no further polishing or buffing treatment, so that it may be sent forward for chromium plating and thus eliminate the cost of the nickel finishing operation. While this is often achieved today and the process is now so certain that there are many automatic plants throughout the country with bright nickel plate and chromium plate in one line without interruption between the nickel and chrome stages, nevertheless all too often one encounters plants where bright plating has only been partially achieved. In such plants the percentage of plated work which goes straight through to chrome may vary from nil to, say, 80 or 90 per cent, the remainder having to be buffed after nickel. This represents a considerable outlay in metal finishing cost, which is often tolerated, when by certain and often minor adaptations the full net saving might be effected. It is not suggested that this is applicable to every case, because obviously there are certain classes of article of extreme complexity of shape which do not lend themselves to receiving a uniformly bright nickel deposit. It behooves us today, however, to examine very closely the plating sequence with a view to increasing to the utmost possible the percentage of work which by-passes the nickel finisher.

Often considerable improvement can be effected by attention to some of the following factors:

(a) Closer control of the constituents.
(b) Correct racking of the components.
(c) Adequate filtration.
(d) Periodic de-contamination of the electrolyte.

A detailed discussion here of the important practical points in successful bright nickel plating would divert this discussion from its main course, and will therefore be appended at the end of this article.

Electrolytic Polishing

It is now some time since electrolytic polishing was first noted as an important aid to metal finishing practice, and a number of investigators have explored the possibilities of grafting this method of producing a polished, or rather lustrous, surface on to the metal finishing sequence.

The principle, which is to make the article an anode in a suitable electrolyte and under suitable electrolytic conditions remove the high-lights of a matte surface, is well known. It may at first appear to be surprising that electrolytic polishing has not been as widely adopted as was first forecast by some, since it appears to be the answer to the polishing problem. Experience has, however, shown that there are certain limitations to the process and it is important that these should be widely realized. It is when these limitations are appreciated that the best possible use will be made of the advantages which electropolishing undoubtedly offers, even at the present stage of development.

If the ultimate aim is the production of a degree of polish which is achieved by mechanical means, then it should be realized that so far as these processes have been explored to date, the chances of achieving the appearance which a Beilby flowed layer produces—particularly under economic or commercial conditions—are not favorable, except in special instances. A great deal depends on the nature of the metal polished and particularly the surface condition. With respect to the former, best results are obtainable on material of high purity or of single phase, a case in point being electro-deposited nickel, which, if produced free from surface defects initially, can be electropolished to a very high degree, not far short of a buffed nickel finish. In general, however, what is produced should more accurately be described as a high degree of reflectivity rather than polish. Indeed, the degree of reflectivity can be higher, as is now well known, than that which is attainable by mechanical methods, as, for example, in the case of aluminum. On

the other hand, it may be that the finish produced, which is softer and approaching more to the satin polish, may be preferred by the user. As mentioned earlier, the use of electrolytic polishing can result in introducing a type of finish which could readily be popularized and might thus lead the trend away from the hard looking, highly buffed chrome finish.

The second point which has been established with respect to electropolishing is that it cannot be looked upon as a method comparable with mechanical polishing for removing scratches which have any appreciable depth. To remove such scratches might not be impossible, but it would entail considerable extension of the time of treatment in the polishing bath, and while this might be practicable in certain instances, it would as a practice prove to be very undesirable because of the considerable acceleration in the rate at which the solution would be contaminated. The following table illustrates this point and gives some idea of the time factor in removing scratches of the order of 100, 140 and 200 emery on a steel surface. The finished grades produced were 'A,' which is equal to an acceptable commercial finish; 'B,' a finish which is midway between acceptance and rejection, and 'C,' definite rejection.

TABLE I.

Emery Finish	Time (50 amps./sq. ft.)	Electropolish Finish obtained
100 emery	1 minute	'C'
	6 minutes	'B'
	10 minutes	'A'
140 emery	1 minute	'C'
	3 minutes	'B'
	7 minutes	'A'
200 emery	¾ minute	'C'
	2 minutes	'B'
	3 minutes	'A'

These figures were obtained by the author in an electrolyte of the sulphuric acid/phosphoric acid type, and in such an electrolyte it is not desirable to extend the time of electropolishing to much more than 3 to 5 minutes, normally.

This table gives a useful guide to a possible development whereby electrolytic polishing can be made to fit into a sequence of operations even when it is found that little or no polish results on material as it is initially sent into the factory. It may be that a combination of mechanical polishing and electrolytic polishing will give the desired result and still effect appreciable savings in the total cost of polishing. For example, in the case of the above steel, it might be desirable to polish mechanically to produce a 140 emery surface and then to electropolish for five minutes, and thus produce a passable finish for the purpose in mind. (See Fig. I.)

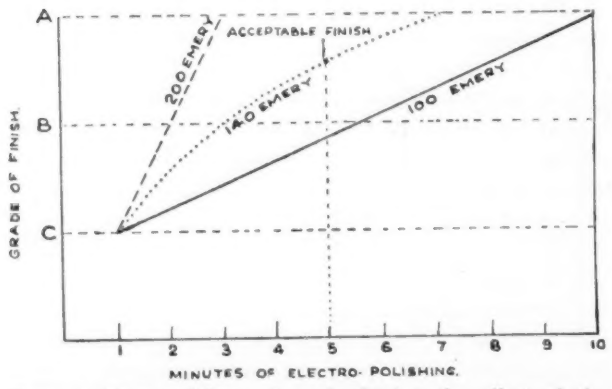

Figure I—Electropolishing of steel, showing the effect of the initial surface condition.

It is not the purpose of this paper to deal at any length with the most recent developments in electrolytic polishing, but to consider what practical difficulties have emerged thus far and to what degree they may be overcome in order that this process may prove to be a useful tool in reducing polishing costs.

Electrolytes

One of the most important aspects of electropolishing is the progressive contamination of the solution which occurs as a result of the surface of the component dissolving and the effect of this on the life of the bath.

Many of the solutions advocated are based on mixtures of phosphoric and sulphuric acids with other additions which are introduced for various purposes, such as the strengthening of the anode film, reduction in anode efficiency, increase in throwing power of the electrolyte, etc. The baths may broadly be considered to be either of the 'finite' or 'infinite' variety. A finite bath is one in which the contaminants do not precipitate out and are difficult to eliminate in any other way and so in time 'poison' the bath so that it has to be discarded. The infinite type of bath either precipitates the contaminants progressively or deposits metal on the cathode and so keeps the rate of contamination down. A bath which is finite in its life is not necessarily undesirable on that account, in that it is dependent on the cost of the make-up of the solution as to whether it is not more economical to dump the electrolyte periodically. An infinite bath is not literally endless in its period of usefulness, and in time, in fact, also becomes clogged with contaminants despite precipitation or deposition.

In the phosphoric/sulphuric acid type of solution, phosphates are in general more soluble than the sulphates in the highly acid solutions which are used. Ferrous sulphate, for example, which accumulates when steel, whether carbon or stainless, is employed in electropolishing, is less soluble in concentrated acid than in weak acid and so tends to precipitate, whereas the phosphate tends to remain in the solution.

Other constituents affect the general picture of precipitation, for example, chromic acid, which is popularly added to some types of phosphoric/sulphuric electrolytes. Chromic acid has not, in the author's experience, proved to be a useful stabilizing factor where stainless steel is electropolished, although it does initially produce a noticeably increased degree of polish. What happens when chromic acid is pres-

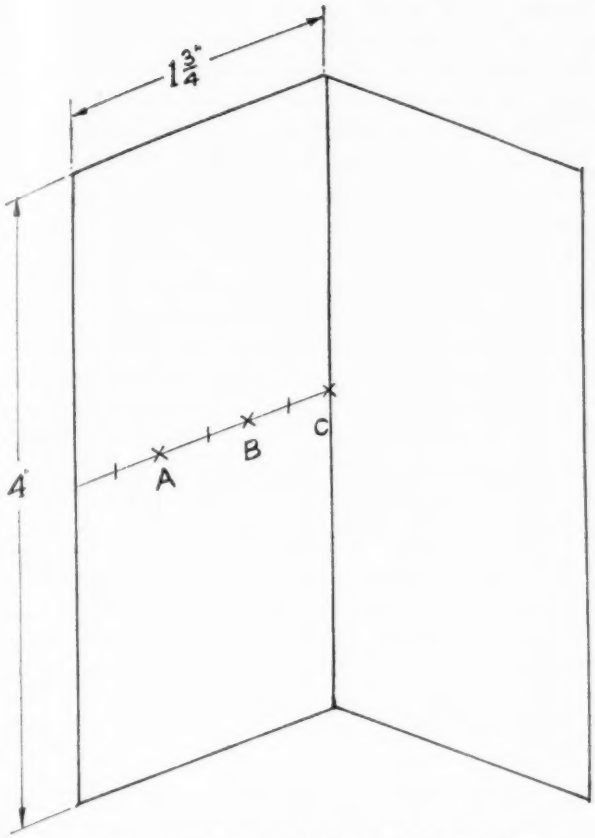

Figure II—Removal of nickel by electropolishing.

ent is that at the cathode hexavalent chromium is reduced to trivalent, and ferric ions to ferrous, while at the anode the chromic acid is reduced to the trivalent condition and also oxidizes the iron to the ferric condition in which condition it is more soluble and then more apt to accumulate in the electrolyte.

In practice, the control of the solution is dependent on periodic analytical checks. Thus, phosphoric and sulphuric acids are relatively easily controlled, since by titrating against alkali, methyl orange will account for the whole of the sulphuric acid but only one of the hydrogen ions in the phosphoric acid, the latter being transformed to sodium di-hydrogen phosphate, whereas phenolphthalein accounts for the sulphuric acid plus two hydrogen ions, transforming the phosphoric acid into disodium hydrogen phosphate. The difference between the two titration figures is therefore equal to one-third of the phosphoric acid present.

Density and viscosity measurements are also useful criteria in the build-up of contaminants in the electrolyte. However, it is a fact that each solution has to be considered on its merits, and a system of partially discarding part of the electrolyte periodically and replacement by fresh electrolyte is one way of keeping the solution at its maximum degree of polish efficiency.

The following contamination figures were obtained in the case of an industrial unit largely used for electropolishing stainless steel. It was found that the iron, nickel and chromium contents of the bath rose almost in the same ratio as their proportion in the stainless steel alloy (18/8) and that the bath began to lose its usefulness when something of the order of 60 grams/litre had accumulated; of this the iron content was of the order of 40 grams/litre. As against this experience, higher chrome contents have been claimed as being still inside the realms of safety, e.g., it has been suggested that as much as 30 grams/litre of chromium might still be tolerated, but this experience has not been confirmed by the author.

As to what constitutes a useful life of an electropolishing solution, experience has shown that one may expect somewhere between 1,000 and 2,000 amp. hours per gallon, and that at this rate of replenishment the solution does, in fact, pay economically as a polishing unit. As a comparative figure, the cost of electropolishing a square foot of stainless steel may be in the region of 2 to 3 cents, and the cost of electropolishing an article, say, of the order of five square inches might be in the neighborhood of about one-tenth of a penny, or better. Obviously the attraction of electropolishing is dependent on the type of article, and in particular the complexity of its shape. Electropolishing will follow contours and throw into angles which are inaccessible to the manual polisher; hence it is of particular interest in the polishing of smaller components of fairly irregular shape.

Electropolishing of Nickel

A point which must, however, be kept in mind with respect to the electropolishing of nickel in particular is the fact that the throwing power is normally better than that of the nickel electrolyte and that, therefore, comparatively more nickel is removed from recesses than from protuberances. This is shown in the following tables—Tables II and III—in which thickness determinations obtained on the specimen illustrated in Fig. II were analyzed. The specimen consisted of a piece of steel folded at right angles, as illustrated, which was first nickel plated and then subjected to electrolytic polishing under different conditions, as follows:

Operating Conditions	Electrolyte
No. 1.	
Phosphoric acid	63% by weight
Sulphuric acid	15% " "
Water	22% " "
Current density	350 amps./sq. ft.
Temperature	115°F.
Time	30 seconds

Operating Conditions
No. 2.
As No. 1 but time increased to 45 seconds.

Operating Conditions	Electrolyte
No. 3.	
Sulphuric acid	73% by weight
Water	27% " "
Current density	300 amps./sq. ft.
Temperature	75°F.
Time	30 seconds

Thickness determinations were then carried out at

the points A, B and C respectively on the test specimens. The results are shown in Table II.

TABLE II. Nickel Thickness

Position in Test Piece	Unpolished Nickel Deposit	*Polished Deposits* 1.	2.	3.
A.	.00068″	.00070″	.00064″	.00067″
B.	.00036″	.00024″	.00022″	.00016″
C.	.00009″	.00005″	.00005″	.00003″

A measure of the throwing power was then obtained by taking as a ratio the relative thicknesses of $\frac{B}{A}$ & $\frac{A}{B}$ and of $\frac{C}{A}$ & $\frac{A}{C}$ respectively. Obviously the higher $\frac{C}{A}$ and $\frac{A}{C}$ ratios are, the better is the throwing power.

The figures are given in Table III.

TABLE III. Throwing Power

	Unpolished Nickel Deposit	Polished Deposits 1.	2.	3.
$\frac{B}{A}$	0.53	0.34	0.34	0.24
$\frac{C}{A}$	0.13	0.07	0.078	0.047

From this it is apparent that:

(1) Electropolishing of the nickel surface has markedly affected the nickel thicknesses as the recess is approached.

(2) The phosphoric/sulphuric acid electrolyte is superior to that based on sulphuric acid alone.

The overall removal of nickel as affected by current density is shown in Figure III.

Conclusion

The above summarizes some of the more important practical aspects of electropolishing, and the conclusion one may come to is that while development is still progressing in this field, it already offers a means of reducing polishing costs in certain specific directions. On the other hand, it is a tool which must be used with caution and understanding. In a recent paper, *Berger* well illustrated how the process had been adapted to everyday use in a job plating plant, but there is no doubt that the success which attended Berger's efforts largely resulted through an understanding of the capabilities and limitations of the process and its application to the correct material.

There remains the point, already stressed above, of educating the customer or user to a new standard of finish which, produced by any of the methods described in this paper, may differ appreciably from that normally obtained by the expenditure of the brawn and muscle of the manual polisher and the physical work which is done on a given metal surface.

There are some inducements to offer which should not be forgotten. In particular, where bright nickel plating is employed instead of that attainable from the Watts type electrolyte, which is then buffed, all the nickel as deposited is retained on the surface and, in consequence, there is no percentage of the nickel in varying, unknown, quantity which is removed when the nickel undergoes subsequent buffing. Not only is this a saving in nickel, which is not an inexpensive metal, but the whole of the nickel remains as a protective for the basis metal and so results in corresponding superior corrosion resistance.

Appendix

Successful Bright Nickel Plating

In England we are at present mainly concerned with bright nickel solutions of the type obtained from the Weisberg or Heinrichsen electrolytes. Both these types of solutions are widely in use today and the specified processes result in the production of a cobalt-nickel alloy containing some 15 to 18 per cent of cobalt. The cobalt is either introduced into the solution via the anodes or more popularly by addition of cobalt sulphate. The cost of cobalt is an important factor and one which merits investigation today with a view to its reduced use in either type of electrolyte. There is more than some promise of a possibility that changes may be introduced in the manner of processing which may result in substantial economies. This would be particularly welcome at the moment when cobalt supplies are on the wane.

Returning to the factors enumerated above, to produce the highest efficiency in the cobalt-nickel solution, probably the most important is connected with very close maintenance of solution purity. It goes without saying that the constituents require to be checked by analysis periodically and the bath replenished so that the specified formula is adhered to and all possible sources of contamination eliminated.

Unfortunately, there are very many ways in which the bath can be contaminated, and to deal with them all may seem to be irksome, but in the long run there is nothing which repays such attention so much. Impurities may enter from the following causes:

(1) The atmosphere.
(2) The tank material.
(3) The articles being plated.
(4) The racks holding the articles.
(5) Any equipment with which the solution may be in contact, e.g., the filters, pumps, etc.

Care is widely taken now to ensure that as far as possible the solution is in contact either with non-corrosive materials if they are metal, or alternatively, inert materials such as rubber and plastics.

It is not proposed to deal with these here but to consider what is probably the most potent cause of reduction in brightness of the deposit, namely, the

contamination of the solution by the articles undergoing plating. The degree of contamination and its effect varies with such material, and while copper and perhaps also brass and steel are not dire offenders, very serious difficulties occur with zinc as a base metal.

Solution Purification

It has now been shown by experience that the most effective way of recovering a solution which has deteriorated is by low current density treatment. The effectiveness of this could be very much increased by the use of this treatment not merely as a corrective, but as a continuous measure while plating proceeds, so that in effect there is at work a continuous de-contaminating influence as deposition goes on. In the treatment of zinc base die-castings, it may be said that no greater relief from the problems surrounding the production of continuous bright plating has been attained than by means of continuous and intensive low current density treatment. This is effected by the use of a separate cell to which the main solution is pumped and circulated, and in which the low current density treatment is carried out while plating continues in the main solution.

All factors which intensify this treatment appear to help de-contamination; thus, the best practice includes the following:

(1) Use as large a cathode area as is practicable.
(2) Have this cathode area broken up, either by using corrugated sheet which provides varying current densities over its surface, or alternatively, a slat type of construction which additionally enables good circulation of the electrolyte through the cathode as well as along its area.
(3) Use a good flow of solution through the cell so that the actual electrolyte in contact with any surface is constantly changing.
(4) Agitate the solution. This is really a simple method of bringing as much volume up to the cathodes as possible but is nevertheless extremely important in its effect.
(5) Where the cell has necessarily to be small, then reduce the anode/cathode distance, interfering as little as possible with the volume of flow of the electrolyte.
(6) By the use of suitable baffles it is possible to direct the flow of solution so that it passes the cathodes in turn before leaving the cell and re-entering the main solution. (See Fig. IV.)

It may be recalled that at one time there was considerable advocacy of the use of a precipitating technique whenever the brightness of the solution fell off and required to be re-established. Reference to this was made in a paper by the author in 1938. While it is in fact possible to re-establish brightness by this procedure, this technique in the light of present experience must be considered to be secondary to the low current density treatment. There are obvious practical drawbacks to the use of the precipitating method, of which the following may be instanced:

(1) Necessity of stopping production while precipitation is carried out.

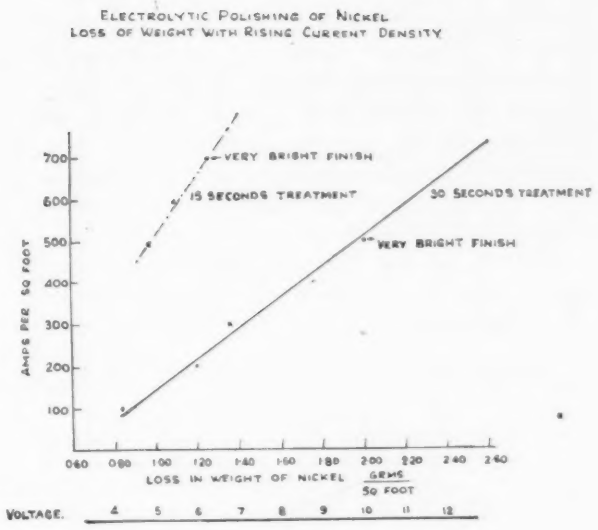

Figure III

(2) The considerable time factor necessary to remove the precipitate (which, incidentally, is a somewhat messy operation under the best of conditions).
(3) The quite considerable loss of electrolyte which inevitably results from precipitation.

There are times when the technique is necessary, but where possible it should be avoided, and often it can be if the greatest care is taken in the use of the continuous low current density de-contamination scheme outlined above.

An investigation was recently carried out in a large works in Birmingham where the problem of plating very considerable quantities of zinc-base material was studied with a view to producing the highest proportion of bright nickel work in a continuous automatic plant.

One of the first things that had to be developed was a reliable method for analyzing for minute quantities of zinc in the ordinary bright nickel solution. The difficulty is due to the fact that to separate traces of

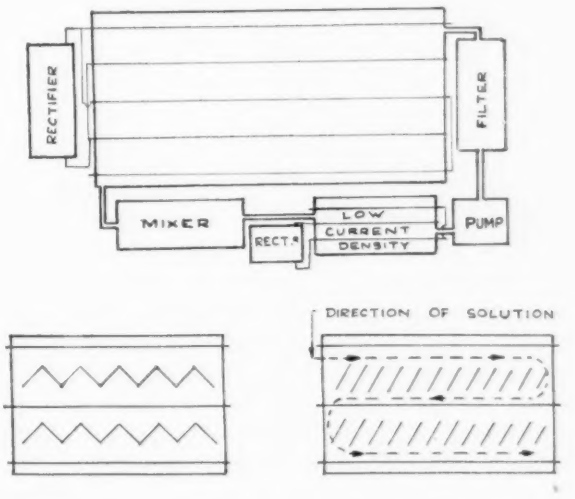

Figure IV—Schematic diagram of low current density purification unit.

zinc quantitively from comparatively high concentrations of nickel and cobalt is a particularly difficult analytical operation. Various methods have been described for determining zinc in somewhat similar solutions, but they were not found to be in any degree reliable. This was undertaken by *D. F. Phillips* and *L. J. Holton*, who finally made use of a special technique using diphenylcarbazone as a reagent and determining the zinc by absorptiometric means. The following table indicates the considerable accuracy in the evolved method:

TABLE IV. Zinc Determination in Nickel Plating Baths

Absorptiometric Method After Acridine Hydrochloride Separation

Solution Used	Subsequent Treatment	p.p.m. Zinc Present	p.p.m. Zinc Found
5 ml. of standardized bright nickel plating solution plus zinc additions.	Acridine hydrochloride precipitation followed by absorptiometric determination of zinc.	23	25
		33	31.5
		38	36.5
		53	54
		63	64.5
		73	74
		83	84

It had been previously ascertained that amounts of zinc in the electrolyte exceeding some 50 p.p.m. were detrimental, and to eliminate trouble from this source it was desirable to reduce to less than at least 40 p.p.m.

Table V (due to *H. D. Carter*) below indicates the effect of variation of current density on the zinc content reduction of a typical bright nickel solution.

TABLE V. Effect of Variation of Current Density

Time of treatment—approx. 4 hours

Current Density (amps./sq. ft.)	Reduction of Zinc Content (p.p.m.)
1	9
3	13
5	7
30	9
60	18
Temperature 54°C.	pH (electrometric) 4.0

This indicates that de-contamination occurs at all current densities, at any rate from 1 to 60 amps./sq. ft., so that, in fact, even while the solution is plating normally at anything from 40 to 60 amps./sq. ft. it is at the same time de-contaminating itself. The rate, however, at which it is becoming contaminated must obviously exceed the rate of de-contamination, and therefore auxiliary cathodes must be employed.

Since it is also important to take into consideration the loss of nickel and cobalt resulting in the de-contamination treatment, it is obvious that the lowest current at which this is carried out effectively is the one which would be the most economical to employ.

TABLE VI.

C. D. amps./ sq. ft.	Ampere Hours	Decrease in Zinc Conc. (p.p.m.)	Zinc Removed (p.p.m./ amp. hr.)	Efficiency per cent
1	0.25	9	36	12.5
3	0.81	13	16	5.3
5	1.34	7	5.2	1.7
15	4.1	13	3.1	1.0
30	7.9	9	1.2	0.4
60	15.5	18	1.1	0.4

The efficiency of de-contamination is illustrated in Table VI, where varying C.D.'s were tried, each for a period of approximately 4.5 hours. From this it is seen that the greatest amount of zinc is removed per unit volume at the lowest current density for each amp. hour which is passed. The most effective c.d. is of the order of 3 to 5 amps/sq. ft.

It is interesting to compare the low current density treatment with the basic nickel carbonate precipitation technique. The latter results in quite heavy reduction in the zinc content, as indicated in the following table:

TABLE VII.

pH of Solution before Precipitation.	p.p.m. Zinc.
Original solution contained	79
4.9	83
6.1	41
6.5	26
6.8	2

Unfortunately, however, as stated above, there are very serious losses of electrolyte which accompany the precipitation technique.

Incidentally, it is an interesting fact that of the various precipitation techniques, that proposed by *Liscomb* was found by experiment to produce the most disappointing results. Liscomb's method differs from the normal precipitation (using basic nickel carbonate). A solution of ferrous sulphate is added to the contaminated electrolyte, the pH of which is raised to 5—5.5, and hydrogen peroxide thereafter added to coagulate the resultant precipitate of ferric hydroxide.

Quite unexpectedly, it was found that the result of this treatment was only capable of reducing contamination from 79 p.p.m. to 69 p.p.m. zinc.

Racking

The importance of correct racking can hardly be over-estimated, and should aim at three important fundamentals:

(1) To give adequate contact with the cathode bus-bar and so ensure that the specified current density reaches the parts racked.

(*Concluded on page 73*)

Where Do We Go From Here?—Part I

By Joseph B. Kushner, *Metal Finishing Consultant, Stroudsburg, Pa.*

DURING the last Convention of the American Electroplaters Society at Atlantic City, I was sitting in a Boardwalk restaurant having a leisurely lunch, watching the strollers pass by. Suddenly, through the door came a well known electrochemist and plating man with whom I had a nodding acquaintance. He recognized me, waved a greeting and sat down at my table for a bite to eat.

"What did you think of the morning's technical papers on plating?" I asked him out of curiosity.

"Not much," he said. "They're always the same. You never get any new ideas at a plating convention. Always a rehash of the same old stuff. That's the trouble with the plating field. Too limited in ideas. You don't get new developments all the time like you do in medicine or atomic physics. No future in it. I should have been an M.D.!"

I thought of that conversation the other day while looking through a copy of the Patent Office Gazette. Is electroplating really running dry of ideas? Is it so limited in scope and application? Has the imagination gone out of it? Has it a future? Was that electrochemist, who shall have to remain nameless, right?

In my very humble opinion he was very definitely wrong. I firmly believe that electroplating not only has a definite future but is on the verge of new developments that will prove astonishing, and that its applications will become wider and wider; that men with imagination are going to find uses for plating that were never dreamt possible.

Why do I say this? Consider these facts: Electroplating as an art is little more than one hundred years old. Compared to the other arts of man it is an infant in swaddling clothes. As a science it is even younger than that, for it is only in the recent past that adequate theories have been developed to explain some of the things that happen in a plating bath. And yet these theories are only tentative, as all theories must be, for in electrodeposition we are dealing with Nature's imponderable, electricity and subtle chemical and physical forces which have yet to be fathomed. Indeed, we are dealing with atomic and sub-atomic forces of which we can only recognize the outward manifestations.

As we gain more and more knowledge of these forces a newer outlook will permit us to make radically different developments. Thus in electroplating up to now we have been working in the dimensions of chemical constitution, temperature and current density. There is another dimension, pressure, which we have yet to add in the operation of a plating bath. The chemist uses high pressures to effect reactions which would otherwise not take place. In the manufacture of ammonia by the reaction of nitrogen and hydrogen, for example, pressure is a vital factor. Without it the reaction could not take place in any appreciable amount. Perhaps it may be a fact that at high pressures certain metals which ordinarily cannot be deposited from aqueous solutions will be amenable to deposition. Who knows?

Consider also the electrical energy used in plating. Do we know everything about its proper application to a plating bath? At first it was thought that batteries were the best source of current for plating. Then came the use of generators. When rectifiers made their first appearance they were looked upon with suspicion as a source of current because they supposedly did not supply the proper wave form to produce a good deposit. The writer recalls after designing the first commercially sold selenium rectifier for electroplating, which consisted of a simple single phase half-wave circuit, the doubt with which it was met. Yet, with the exception of chromium plating, it gave excellent results with every metal tried. A change over to three phase circuits and full-wave rectification corrected the chromium plating uncertainty com-

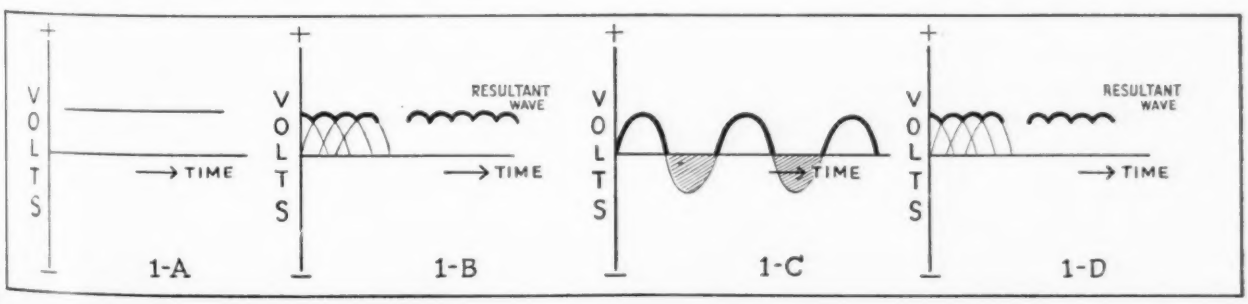

Figure 1. Resultant wave forms for various types of power sources.

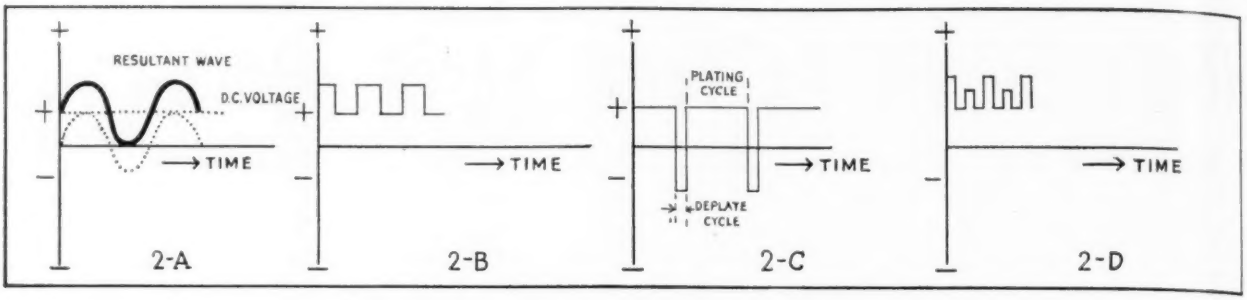

Figure 2. Special wave forms resulting from superimposed and interrupted power supply.

pletely and proved that rectifiers were excellent for all plating purposes. Incidentally, recently some Russian researchers have shown that deposits plated out from a half wave, single phase rectifier are better in structure and somewhat lower in porosity than those plated out with other direct current sources, which proved the old pioneering model was not so bad after all, outside of somewhat lower electrical efficiency.

The form of the electrical wave used in plating, we are only beginning to find out now, is of great importance in determining the nature of the plated deposit. Thus with a battery we get a wave form which looks like a straight line (Figure 1 a). With a generator the wave form is something like that shown in Figure 1 b. It is almost straight with a slight ripple (small amount of bumpiness). With a single-phase half-wave rectifier, the wave form looks like Figure 1 c (a considerable amount of bumpiness). With a three-phase full-wave rectifier, the wave form looks something like Figure 1 d approaching the generator wave form in smoothness.

Several years ago in Germany the discovery was made that by superimposing an alternating current on a direct current, better plating results were obtained. Such a combination results in a variety of wave forms one of which is shown in Figure 2 a. This was picked up in this country and some new ideas were tacked on. Somebody thought of using a pulsating current instead of an alternating current, which results in wave forms of the type shown in Figure 2 b. Then along came another bright experimenter and introduced the idea of reversing the current momentarily to give a wave form something like that shown in Figure 2 c. This practice, which causes a slight deplate alternately with the plating process, seems to produce smoother deposits of metal at higher current densities. Now some German experimenters have advanced the idea of using varying but definite time pulses of current at definitely related voltages, to give a wave form shown in Figure 2 d. This wave form, it seems, gives better results in the plating out of alloys.

This subject of electrical wave forms as it applies to plating offers a world of possibilities. The electroplate as put down goes down atom by atom on the cathode surface—we are actually building a metal surface with nature's building block—the atom. By use of the proper wave form for a given metal and by proper timing we may be able to put down a much superior plate of metal or combination of metals we call an alloy. We all know that in nickel plating, for example, if you interrupt the current for any length of time you may get a worthless double plate, yet interruptions in the order of micro or milli-seconds timed by electronic timers may be just what the doctor ordered to produce a stronger, denser plate. A similar though reversed effect may hold in electropolishing. Who knows?

Chemical forces brought into play in plating can be a source of new ideas. Thus, the idea of a catalyst is something only recently introduced in plating. In the early twenties, before chromium plating was made practical, no thought was given to the use of catalysts as applied to electroplating. After all, however, a deposit is produced by a chemical reaction, and chemical reactions can be made to go in one way or another by the use of catalysts. The process of chrome plating cannot take place successfully unless there is present in the solution a little bit of sulfate or fluoride, which acts as a catalyst in that it permits a reaction to take place which under ordinary circumstances would not take place if the catalyst were not present. Is chromium the only difficult-to-plate metal that can be plated out by the use of a catalyst? In spite of all the learned treatises which state that only certain metals can be plated out of aqueous solutions, it is still conceivable that some of these presently non-plateable metals can be deposited by the use of proper catalysts.

Another chemical field to explore as it concerns plating is that of sequestrants. What is a sequestrant? Simply a chemical compound that ties up small amounts of metal in non-ionic form. Metals tied up this way cannot be deposited, as they are not ionized, but they remain in solution nevertheless. We all know how sensitive a plating bath can be to small amounts of metallic impurities and the nuisance it is to remove these impurities or prevent their entry into a plating bath. Here then, by the use of selective sequestrants, we may have the answer to the contamination nuisance in electroplating! A simple idea but well worth trying.

What is the chemistry and physics of bright plating? Through pure accident, a British plater many years ago discovered that silver deposits were considerably brightened if a little carbon bisulfide was present in the bath. This became a trade secret, but it eventually leaked out. There was no adequate theory to explain why it should be possible to get a bright deposit of metal. Even the theories we have today do not completely explain it. But the value of a theory is that once you have one you have a plan to go by, something that will help you make even

greater discoveries—provided your theory is right! It gives you a line to follow in order to make improvements. On the other hand, if your theory is wrong following it as a map gets you nowhere, and you have to end up by rejecting the theory or map and drawing a new one.

We can plate nickel as heavy as we please and get a mirror bright deposit for as long as we plate, because of developments during the past ten years or so. Why can't we do the same with all other metals? What topochemical and topophysical forces produce the bright plate and how can we control them?

The dimension of temperature and the dimension of pressure can be explored in plating with undoubted benefit. Raising the temperature of a plating bath permits the use of higher current densities, but you cannot go above the boiling point of a solution unless you apply pressure. If you apply pressure to the plating bath you can increase the temperature to almost any desired point. On the other hand the application of pressure without raising temperature offers many interesting possibilities, as pointed out by the writer in a previous paper on fluid mechanics in electroplating.

Then there is the up-and-coming field of alloy plating. Here is a good way for combining metals to obtain new characteristics without making use of a furnace. The metal tungsten is so refractory it is practically unmeltable, but it can be plated out in alloys in percentages as high as 50%, combined with cobalt, nickel or iron. Here is a combination of metals that is tremendously strong, highly resistant to corrosion and oxidation. Surely it should be possible to electroform such alloys into exhaust pipes, turbo jet tubes and dental plates, to name a few items that come to mind.

What about electrophoresis, which in simple terms is the plating out of non-conductive particles? Rubber, plastics, almost any type of non-conductive particle if it is of the proper size and suspended in the proper medium, can be plated out in a uniform coating. This field of electroplating has truly only been scratched on the surface.

This necessarily brief survey has undoubtedly left out many theoretical ideas in the realm of electroplating, but I think even the electrochemist who started this train of thought will have to agree that electroplating is not moribund, that it has a good future and many possible avenues for future development.

(*To be continued.*)

REDUCING FINISHING COSTS

(*Concluded from page* 70)

(2) To insulate those parts of the rack which are not in contact with the plated articles.

(3) To hold the work effectively so that it does not become detached and by falling into the solution aggravate the contamination difficulty.

Regular inspection of the bottom of the solution to retrieve articles which may have become detached from old or defective racks is highly important, and this can be carried out concurrently with periodic emptying of the solution via the filters, so that the tank itself may be cleaned out as frequently as production will permit.

Effective insulation of the rack is important and development work is still proceeding to achieve the most efficient rack coating material. This must not only be highly insulated, but possess good mechanical properties and a high degree of adhesion to the rack itself. Adhesion is important not merely to prevent breakaway of the insulation from the rack, but because if this properly is not present then solutions become trapped between the rack and the insulator and carried over into the bright nickel solution, again aggravating contamination problems. Needless to say, this is of particular importance in the operation of continuous automatic plating plant where the same racks are in contact with each and every solution in the plating sequence. Not only does this affect the maintenance of bright plating, but other undesirable effects also occur. For example, if chromic acid is trapped between the insulator and the rack material and brought back again into the cleaning cycle, quite disastrous consequences may ensue in the plating, for example, of brass components, which may apparently, and quite incomprehensibly, suddenly develop lack of adhesion of the nickel deposit to the base material.

Filtration

Filtration is, as always, important, although there are two schools of thought with respect to the manner in which filtration is most effectively carried out. According to the first school, the desirable aim is as intensive filtration of the solution as possible. The alternative view is that while the continuous filtration is very helpful, it is not as effective as the removal of the solution bodily from the plating tank via a filter into an auxiliary tank and its subsequent pumping back into its original tank. Undoubtedly the latter procedure does ensure that the whole of the solution has been filtered effectively, whereas with continuous filtration it is extremely difficult to catch up, so to speak, with the rate at which the solution is being contaminated. Experience has shown that the best procedure is to employ both these filtration techniques.

Shop Problems

Abrasive Methods—Surface Treatments—Control
Electroplating—Cleaning—Pickling—Testing

METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gratefully received and the sender's name will be kept confidential, if desired.

Plating Specifications

Question: We are interested in obtaining information concerning commercial specifications for various types of plating. Can you tell us where such information may be available?

M. O. S.

Answer: The American Society for Testing Materials, 1916 Race St., Phila., Pa., has published in pamphlet form, available at $1.25 per copy, their complete specifications for electrodeposited coatings. These specifications cover Zinc on steel, Cadmium on steel, Nickel and Chrome on steel, Nickel and Chrome on copper-base alloys, Nickel and Chrome on zinc-base alloys, Lead on steel, Chromate finishes on zinc, Hard Chrome directly on steel, and also test methods for thickness and salt spray resistance.

Many of the large manufacturing concerns, who either do their own plating or purchase plated items, have drawn up their own specifications, based on their respective experiences with service life of their products. Copies of these specifications may often be obtained from the firms, and should be helpful to you.

Bright Dipping Silicon Bronzes

Question: When we use our regular brass bright dip for parts made of silicon bronze, we notice that it is very difficult to obtain a bright surface. The parts come out quite dull, although the dip works well on other parts treated at the same time. Should we use a special dip for this silicon metal? Please send us the formula for such a special dip if there is one.

E. V. D.

Answer: Parts of silicon bronze, especially those that have been heat-treated, have a surface film containing silicon dioxide, which is not soluble in the ordinary acids used in bright dips for brass. After pickling in a 10% sulfuric acid solution, a dip in the following pickle will produce a bright finish on these alloys:

Sulfuric Acid	5-10% by volume
Nitric Acid	10-20% by volume
Hydrofluoric Acid	3-5 % by volume
Water	Remainder

This solution must be held in a special tank having a wax or asphalt lining, as it will attack metal tanks or ceramic crocks. A hood should also be provided, as irritating fumes are given off.

Finishing Aluminum Hand Railings

Question: We are makers of aluminum and stainless steel hand railings for offices and residences. One of our problems is the satisfactory finishing of these railings to produce a satin finish approximating the finish obtained by hand finishing with aluminum oxide cloth with 120-150 grit. Our problem is further complicated by the fact that we never have two railings exactly alike. Can you suggest a method whereby we can finish these railings uniformly and economically?

C. S. W.

Answer: Assuming that the railings are assembled and fastened down at the time of finishing, the best way to produce a uniform satin finish would be to use a loose 6" buff mounted on the shaft of a portable electric drill, applying the abrasive directly to the buff from an abrasive bar or "stick." Names of manufacturers who can supply such compounds of the proper grits are being sent to you. If possible, you should protect the surfaces of the bars and rods during manufacturing operations to prevent excessive nicking and scratching, as otherwise these marks will be difficult to remove. Some sort of strippable plastic coating will be helpful in this respect.

In the case of the aluminum railings, if it were at all possible to assemble these before they are fastened down, it would be possible to produce frosted or etched finishes which would be attractive by treating the complete railings in a chemical bath. You might also consider colored finishes that could also be formed either in chemical baths or by anodizing and dying the anodized film. By treating the entire railing in such a manner the tedious job of hand finishing by the above abrasive method could be eliminated.

Anode Films in Cyanide Copper Baths

Question: We are experiencing difficulty in our cyanide copper plating solutions in that the anodes develop a grayish coating. We operate two baths, one old and one new, and have tried removing the anodes and cleaning off this film, but it reforms almost immediately shortly after resuming operations. What can be done to prevent this action?

H.R.D.

Answer: The coating over of copper anodes in cyanide baths can be caused by having either too low a free cyanide content, or using too few anodes, thus producing excessively high anode current densities. The free cyanide content should be checked at

frequent intervals and additions made to the bath to maintain good anode corrosion. To produce the correct anode current density, add enough anodes to the tank to maintain a current density of about 15-20 amps. per sq. ft.

Plating White Metal Parts

Question: In silver plating white metal parts I have considerable trouble with blistering and peeling of the deposits. Having tried a number of variations in cleaning and plating with no apparent improvement, I am writing to ask your help in overcoming this problem.

R. B. A.

Answer: The usual problem in plating white metals lies in the cleaning steps prior to plating. A very mild exposure to alkaline cleaners is essential, as it is very easy to "overclean" and atack the metal in strong alkalies. Remove the buffing compounds and grease in a vapor degreaser or a solvent type cleaner, so that the alkaline cleaning steps can be as short as possible. A 4 oz./gal. solution of a mild alkali such as trisodium phosphate can be used, and if electroyltic cleaning is used the parts should be made cathodic, and very low current densities used. This treatment should be as short as possible to obtain good results. After the alkaline cleaning the parts should be rinsed, then dipped in a 10% solution of muriatic or fluoboric acid for a few seconds, rinsed twice with cold water, then plated in the silver strike solution until completely coated. They can then be transferred to the regular silver plating bath for developing the final deposit. For very dirty work, or for parts containing deep recesses, it may be necessary to brush the parts with the mild alkaline cleaner before electrocleaning.

Removing Chrome Contamination From a Nickel Solution

Question: Can you tell me how to remove chromium impurity from a Watts nickel bath?

U. G.

Answer: Hexavalent chrome (chromic acid) can be removed from nickel solutions by stirring in a small amount of lead carbonate, which will react with the chromic acid to form insoluble lead chromate. The solution should then be filtered to remove the insoluble lead carbonate, and the clear solution electrolyzed (dummied) at a low current density long enough to remove any excess of lead salts that are in solution. This low current density treatment will also remove any copper or zinc contamination at the same time.

Plating Tank Wiring

Question: Does it make any difference in hooking up a plating circuit if the rheostat is inserted into the anode side instead of the cathode side of the tank circuit?

G. V. H.

Answer: Usually the rheostat and ammeter is mounted in the negative (cathode) side of the line, as then it is a true indication that the current indicated on the ammeter is flowing through the work being plated. A disadvantage of this type of hookup is that current can still flow from the anodes (Positive) to the tank wall if there is a "ground" between the tank and the power source. This will only happen with unlined tanks, and will result in a buildup of metal on the inside of the tank. By mounting the rheostat in the anode (positive) side of the line this difficulty is overcome. You can take advantage of both these hookups by mounting the rheostat in the anode line and the ammeter in the cathode line.

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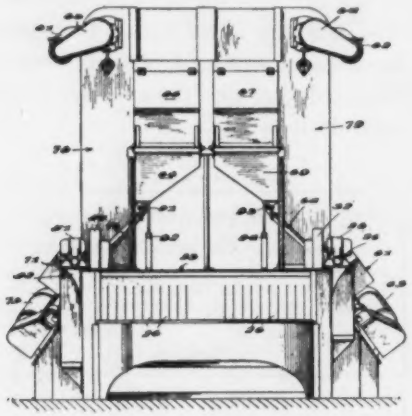
Patents

Abrasive Blast Table

U. S. Patent 2,454,158. *Charles M. Gossard, assignor to Pangborn Corp.*

Apparatus for blast treating articles comprising, a main table supported for rotation in a substantially horizontal plane, an auxiliary table supported on said main table and rotatable about a substantially vertical axis, means for



rotating said main table to move said auxiliary table in an orbital path, means for projecting abrasive at a blasting velocity downwardly in a substantially fan-shaped stream, said projecting means being so arranged that the elongated pattern of the abrasive blast stream is substantially at right angles to the orbital movement of said auxiliary table, and means for rotating the auxiliary table while moving through the blast stream.

Crate for Water Bottles or Acid Carboys

U. S. Patent 2,452,195. *Carl Eugene Johnson.*

A crate for a bottle comprising a metal frame including a base member, four corner posts united to said base member, said corner posts having bases and side portions arranged to form a channel-shaped section, with the bases of the posts turned inwardly of the frame to provide contact-supporting members for the water bottle to be received by said frame, upper horizontal members interconnecting said posts, and a retaining ring having a plurality of extensions, and a plurality of apertures in said corner posts for providing detachable connections for said extensions of said retaining ring.

Coated Abrasive Articles

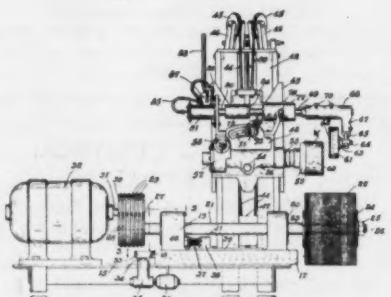
U. S. Patent 2,452,793. *Norman P. Robie, assignor to The Carborundum Co.*

A flexible abrasive-coated article comprising a flexible backing having abrasive particles adhesively secured thereto by a bond comprising the reaction product of a mixture comprising a soluble alkali silicate and a water-soluble, heat hardenable reaction product of an aldehyde and a urea compound.

Holloware Buffing Machine

U. S. Patent 2,453,316. *Robert D. Harris, assignor to The Enterprise Aluminum Co.*

A buffing machine for buffing holloware, including a buffing wheel, means for rotating the buffing wheel, means for axially reciprocating the buffing wheel while it is being rotated, a ware chuck adapted to receive holloware to be buffed, means for rotating said chuck, means for normally holding the chuck spaced from the buffing wheel, a pressure pad, means for normally holding the pressure pad spaced longitudinally and laterally



from the chuck, and fluid pressure and cam means for simultaneously moving the pressure pad into contact with the bottom of hollow ware upon the chuck and moving the chuck toward the buffing wheel to bring the surface of the hollow ware upon the chuck into contact with the buffing wheel.

Surface Treatment of Sheet Metals

U. S. Patent 2,453,429. *Daniel A. Gorman, Sr.*

A method of treating sheet steel in a rolling mill to remove microscopic compacted surface particles resulting from the rolling mill treatment, which consists in running the sheet quickly thru an aqueous acid washing bath containing chromic acid and scrubbing it vigorously with rotating brushes while immersed therein for a sufficient time to loosen compacted surface particles but insufficient to remove any substantial amount of the base metal, the scrubbing removing any oxide that may be formed by the acid so that the sheet remains uncoated, the time of immersion being from five seconds to five minutes, immediately thereafter passing it thru a rinsing bath, and then promptly drying it, whereby the surface is conditioned to more freely release occluded hydrogen.

Bright Zinc Plating

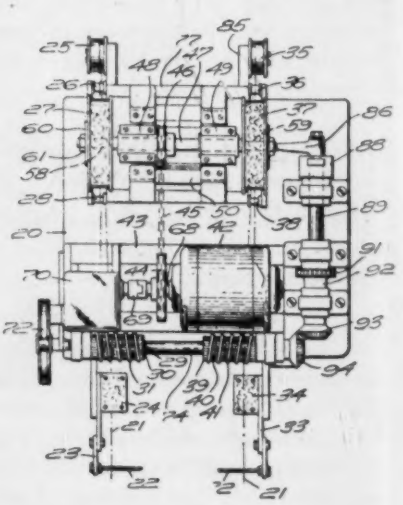
U. S. Patent 2,451,426. *Robert R. Bair and Harry L. Benner and Joseph Frederic Walker, assignors to E. I. du Pont de Nemours & Co.*

The process of electrodepositing zinc from an aqueous zinc cyanide electroplating solution having a pH above 9.0 which comprises electro-depositing said zinc from said solution containing dissolved therein about 0.1 to 2.0 ounces per gallon of the condensation product of sodium cyanamide and formaldehyde obtained by reacting substantially equimolecular amounts of sodium cyanamide and formaldehyde in aqueous alkaline solution at a temperature below 35°C.

Finishing Machine for Ornamental Chains

U. S. Patent 2,454,299. *Ferdinand Armbrust, assignor to Armbrust Chain Co.*

In a chain finishing machine, a power shaft, a finishing wheel shaft, a finishing wheel keyed to said finishing wheel shaft, means for positively driving wheel shaft from said power shaft,



a chain feed shaft, chain feeding means on said shaft, means for driving said chain feed shaft at a reduced speed from said power shaft, including a reduction gearing and a belt driven pulley, means for guiding a chain fed by said chain feeding means into contacting engagement with said finishing wheel, means for maintaining the guided chain under tension, and means for reciprocating the guiding means in timed relation to the chain feeding means to move the contacting chain over the face of the finishing wheel, an idler pulley, a flexible finishing belt mounted on said idler pulley and said finishing wheel, and means for keeping said belt under tension.

Composition for Inhibiting Foam

U. S. Patent 2,453,351. *Henry E. Tremain and Leslie R. Bacon, assignors to Wyandotte Chemicals Corp.*

A composition for suppressing the formation of foam in aqueous systems, consisting essentially of a compound selected from the group consisting of di-tertiary amyl phenoxyethanol, p-tertiary amyl phenoxyethanol, di-tertiary amyl phenoxy-propanol, and di-tertiary amyl phenoxy isopropanol; and 50 to 90% by weight anhydrous sodium carbonate, the resultant composition retaining essentially the dry, solid form physical appearance of the sodium carbonate itself.

Composition for Inhibiting Foam

U. S. Patent 2,453,352. *Henry E. Tremain and Leslie R. Bacon, assignors to Wyandotte Chemicals Corp.*

A composition for suppressing the formation of foam in aqueous systems consisting of, by weight, 20 to 40% di-tertiary amyl phenoxy-ethanol, 35 to 50% 2-methyl-2, 4-penthanediol, 10 to 40% water and 4 to 10% of a sodium petroleum sulfonate.

Semiconductor

U. S. Patent 2,450,887. *Charles Alexander Escoffery, assignor to Federal Telephone and Radio Corp.*

In a process for manufacturing selenium rectifier elements the improvement that comprises incorporating in the selenium layer a minor proportion of a plurality of substances selected from the class consisting of iodine compounds of chlorine and iodine compounds of bromine.

Semiconductor

U. S. Patent 2,450,886. *Charles Alexander Escoffery and Madeline Duane Merva, assignors to Federal Telephone and Radio Corp.*

In a process for manufacturing selenium rectifier elements the improvement that comprises incorporating in the selenium layer a minor proportion of a single substance selected from the class consisting of iodine compounds of chlorine and iodine compounds of bromine.

Cleaning Iron and Steel Surfaces

U. S. Patent 2,455,411. *Francisco A. R. Franchi.*

A process for the treatment of iron in order to obtain a clean metallic surface, in which the iron to be treated is reacted for 5 to 30 minutes in an acid bath composed of by weight 3 to 9 parts of nitric acid, 31 to 33 parts of muriatic acid, 10 to 20 parts of sulphuric acid, 5 to 12 parts of hydrogen sulphide, 1 to 7 parts of sodium acetate and 2 to 9 parts of a compound from the group consisting of potassium hydrogen phosphate (K_2HPO_4) and potassium ortho phosphate (K_3PO_4) for 100 parts of water, is then withdrawn from said acid bath and immersed in an alkaline bath.

Bright Nickel Plating Baths

U. S. Patent 2,455,555. *Henry Brown, assignor to Udylite Corp.*

A bath for electrodepositing bright nickel comprising an aqueous acid solution of a material selected from the group consisting of nickel chloride, nickel sulfate, a mixture of nickel sulfate and nickel chloride, a mixture of nickel fluoborate and nickel chloride, a mixture of nickel fluoborate and nickel sulfate, and a mixture of nickel sulfate, nickel chloride, and nickel fluoborate, said solution having dissolved therein 2-nitrovinyl benzene sulfonic acid in an amount falling within a range of from about .3 gram per liter to saturation, said bath having a pH falling within a range of from 2 to 6.

Alkaline Detergent Composition

U. S. Patent 2,455,648. *Wallis R. Bennett, assignor to Dow Chem. Co.*

The method of making a detergent composition which comprises adding a material selected from the class consisting of zinc oxide and sodium zincate to approximately 76 percent aqueous sodium hydroxide and heating the resulting solution at an elevated temperature over 700° F. but below 830° F. to vaporize substantially all the water therefrom, mixing disodium orthophosphate into the heated solution, and then converting the entire mixture to the solid state, the said ingredients being in such relative proportions that the final composition contains at least 75 percent by weight of sodium hydroxide and from 2 to 10 percent by weight each of sodium zincate and trisodium orthophosphate.

Fluoborate Bright Copper Plating

U. S. Patent 2,455,554. *Henry Brown, assignor to Udylite Corp.*

A bath for electrodepositing bright copper comprising an aqueous acid copper solution comprising essentially a material selected from the group of materials consisting of copper fluoborate, a mixture of copper sulfate and sulfuric acid, a mixture of copper sulfate, ammonium sulfate and sulfuric acid, a mixture of copper fluoborate and hydrofluoboric acid, and a mixture of copper fluoborate, ammonium fluoborate and hydrofluoboric acid, said aqueous acid copper solution also having dissolved therein acetyl cyanamide in a concentration ranging from about .1 to .7 gram per liter, said bath having a temperature falling within a range of from about 50° F. to about 100° F. and containing a greater molar concentration of copper salt than of acid.

Palladium Plating

U. S. Patent 2,457,021. *Edmund M. Wise and Raymond F. Vines, assignors to The International Nickel Co., Inc.*

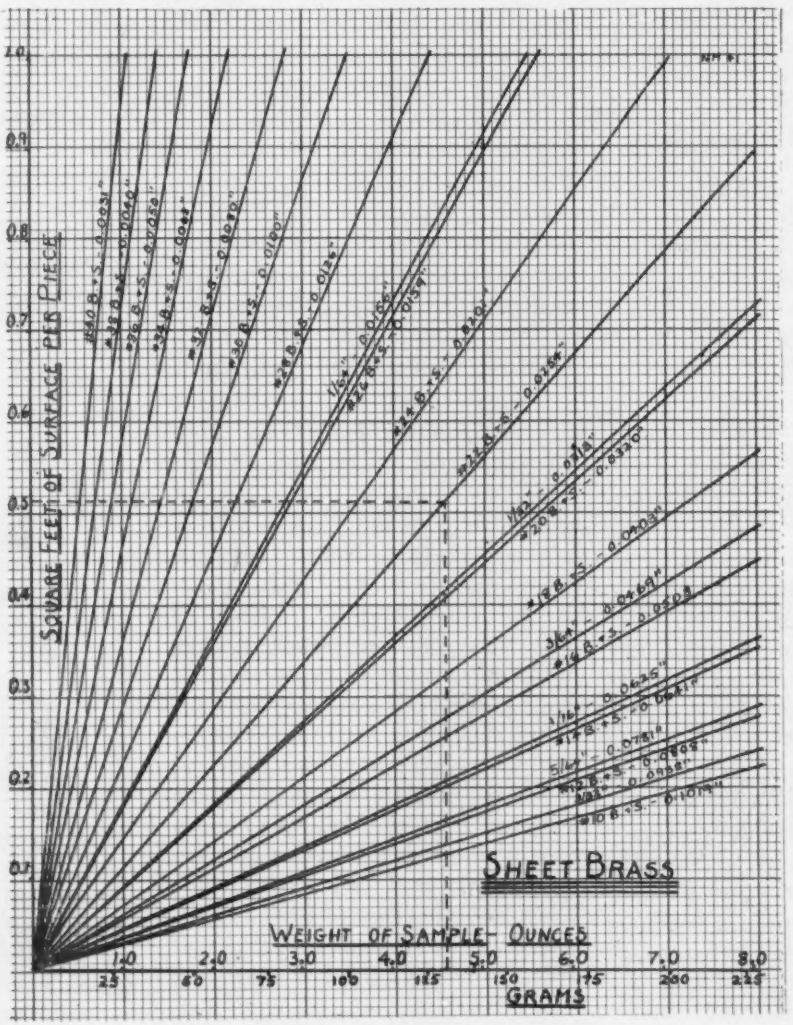
A process for electrodepositing thick, ductile coatings of palladium which comprises establishing an aqueous bath containing about 10 to about 175 grams per liter of palladium principally as palladium chloride and about 50 cc. to 700 cc. per liter of concentrated hydrochloric acid, said bath having a pH not greater than about pH 2.0, immersing a palladium anode and a cathode in said bath, said anode consisting of substantially pure palladium melted under non-reducing conditions, and passing electric current through said bath whereby ductile deposits of palladium up to about 0.025 inch thick are obtained.

Determining Areas of Sheet Metal Parts

1 — BRASS STAMPINGS

The following chart may be used for estimating with sufficient practical accuracy the total plating area of parts made from flat sheet brass. This chart does not take into account the considerable amount of edge area that may be present on the heaviest parts made of thick stock, which can be easily measured and added to the figures found on this chart, nor the areas to be subtracted for holes. All that is required is the weight per piece and thickness of the stock used.

For parts heavier than those included in the chart, the area can be estimated by figuring first the area of a part one-half or one-quarter the weight of the sample part, then multiplying by the appropriate factor of two or four as required.



(Data by N. Hall & C. B. Hogaboom, Jr.)

Stainless Steel Pail

Stainless Steel Container Co., Dept. MF, 1172 Board of Trade Bldg., Chicago 4, Ill.

The Pail is war surplus 18 gauge, solid No. 18-8-304 Stainless Steel; inside, polished; outside, Electro-Glo

finished; 10 inches high and 12 inches in diameter. It is seamless, drawn from a single piece; with an inverted radius bottom. Pail bale and handle are ¼" stainless steel—Capacity is over 16 quarts. Comes packed in individual containers, shipping weight, 10 lbs.

Centrifugal Dryer

The Hanson-Van Winkle-Munning Company, Dept. MF, Matawan, N. J.

Announcement has been made by this firm that two improvements have been made in their Mercil type centrifugal dryer.

1. Instead of a bevel pinion on a high speed shaft with a set screw, a longer shaft is now provided with threaded ends with SKF lock nuts and washers. This improvement eliminates the chances of binding gears.
2. A flange is now provided over the rim of the dryer to prevent work from falling between the basket and the outer shell.

Further details may be obtained by contacting the company.

New Bright Dip for Copper Alloys

Kelite Products, Inc., Dept. MF, Box 2917—Terminal Annex, Los Angeles 54, Calif.

An improved brightener for copper, brass, and bronze has been announced by this firm. The new product, Metal Brite, is said to be extremely fast acting, and to have a long life. Metal Brite is highly concentrated, and is economical because one part of Metal Brite is diluted with two parts of water. It is claimed to produce unusually natural colors on copper, brass, and bronze. The brightening operation takes only fifteen to thirty seconds. Packed in 13 gallon carboys only.

Complete details and samples are available from the manufacturer.

8-Door Fixed Tumbling Barrel

The Sturgis Products Co., Dept. MF, Sturgis, Michigan.

A new 8-door machine for finishing

parts whose size and shape are not adapted to standard Roto-Finish processing methods is announced by the above firm.

Built as special equipment for individual requirements, the new 8-door machine is similar to the standard one compartment Roto-Finish machine, except that each flat of the octagon cylinder is fitted with a large size door. Parts are rigidly fixtured to the back of each door, so that surfaces to be finished are presented to the processing mass. Selective action caused by one-direction processing is overcome by reversing cylinder rotation.

All regular Roto-Finish processes and materials can be used with the 8-door machine and the same quality finishes can be expected as with the standard equipment, it is claimed.

Extra cam locks are fitted to each door to overcome added strain imposed by fixtures on the doors. Doors and fixture plates are interchangeable to handle a multiple of different parts, all of which may be processed at one time. Doors may be obtained unlined or rubber lined. Due to variety of requirements, motor size varies with each application. Supplied with each machine is a magnetic brake, plus a forward and reversing switch. Automatic timer controls are optional. Cylinder shells are extra-heavily constructed, with seams welded both inside and out.

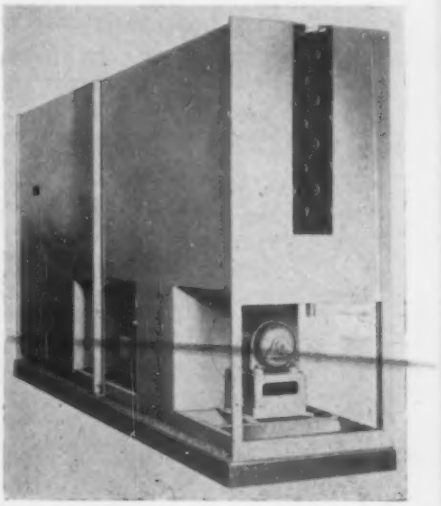
For detailed information on the new 8-door Roto-Finish machine, write to the above address.

Spotless Dryer

Optimus Equipment Co., Dept. MF, 241 Water Street, Matawan, N. J.

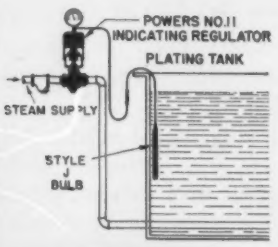
A new mechanical dryer for the spotless drying of metal parts has just been announced by the above firm, manufacturers of mechanical metal washing, degreasing, pickling, and drying equipment.

This dryer was originally designed to meet the needs of the plating industry for the drying of highly polished



POWERS

TEMPERATURE CONTROL



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Stops Losses Caused by OVER-Heating

Stop human errors, mechanize temperature control of plating operations with POWERS No. 11 INDICATING REGULATORS. They maintain a constant temperature, are self-operating and easy to install.

Easy to Read Dial Thermometer indicates temperature in tank. Thermostatic bulb is lead sheathed or made of stainless steel. Powers regulators are gradual acting and ruggedly built to give the dependable control required for good plating.

Will Help You Get a Better Product at Lower Cost Better temperature control of plating solutions will help reduce rough plating, buffing time, insure plating within the bright range and reduce decomposition of solutions. Powers regulators pay back their cost many times a year. They are—

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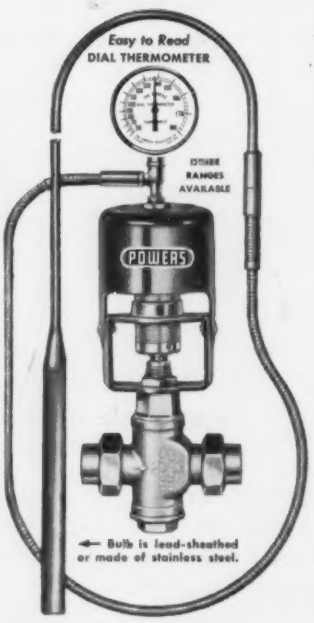

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Over 55 Years of Temperature and Humidity Control

metal surfaces without water spots, strains or streaking. Since then, these new dryers have been adopted for all types of drying of metal parts handled on monorail systems. They are designed to handle the drying of metal parts either on racks or monorail on a continuous production basis, and provide spotless drying after plating or polishing and before subsequent plating or lacquering, it is claimed.

High velocity jet nozzles specially designed and located reduce drying time to a minimum. These nozzles are directional and adjustable. Combinations of cold and hot air drying are employed. Cold blast removes water by mechanical action, leaving a film which is removed by the following hot air blast. Provisions are made to recirculate all possible heated air.

These dryers require a minimum of floor space. Fans, heating units and motors are all located within the framework. Where overhead space permits, these units may be suspended from the ceiling. All auxiliaries are easily accessible for periodic inspection and maintenance, it is claimed. Air for drying can be heated by steam, gas or electricity.

Wedge-Layer Walrus Polishing Wheels

Greene, Tweed & Co., Dept. MF, North Wales, Pa.

Walrus hide polishing wheels of wedge-layer structure that completely eliminate abrasive injury in fine finish-

ing, together with solid walrus hide polishing wheels, have been introduced by this company, as additions to their line of soft-tanned and hard-tanned walrus hide.

Laminated polishing wheels ordinarily are constructed of cement-bound flat discs; thus, when the wheel revolves, the joint areas strike the metal being polished at one point, and cement lodged in the joint will scratch or groove.

Surface scratching is minimized by the Laminated walrus polishing wheel in the use of strong-but-soft cement; all scratch is removed through the wheel's wedge-layer design. Layers are set at an angle; thus, when the wheel revolves, the joint areas weave from side to side of the wheel. This enables the leather to pick up and wipe off any area transversed by the joint areas, removing any cement scratch and smoothing the surface clean.

Design of these wheels provides an additional advantage, for structure of thin-layered walrus leather strips is permitted. Wheels may thus be supplied in any diameter, any thickness at exceptional economy—particularly where thicknesses run high.

Laminated walrus polishing wheels are especially adaptable to the finishing of copper, nickel, German silver, and stainless steels; to the burnishing of unevenly shaped objects; and to working inside wide-mouthed objects.

The introduction of Solid walrus polishing wheels—supplied in all thicknesses up to and including 7/8 in.—fills the need for "side Wheel" applications and those where a soft, pliable leather is required to reach surfaces inaccessible to a rigid, thick polishing wheel.

Further information and bulletin are available.

Light Duty Buffing Lathe

Lewis Roe Mfg. Co., Dept. MF, 1050 *DeKalb Ave., Brooklyn* 21, *N. Y.*

The polishing machine illustrated on this folder was designed for light buffing and coloring work and to take the place of heavier machines for this class of work. The machine is driven by a 1/4 H. P. alternating or direct current motor mounted on the stand.

The machine is equipped with two self-aligning ball bearing pillow blocks and has a 3/4" diameter spindle 22" long. Longer spindles can be furnished if required. The spindles are turned

When "Regular" Cleaners Fail... ask MAGNUS for the Answer

There are special Magnus Cleaners for many common metal cleaning operations where ordinary cleaning compounds just can't do the job. Here are a few of them:

Cleaning after Oil Quenching Dirt deposits are particularly stubborn, calling for strong alkaline cleaning action, plus penetrating, wetting and rinsing effects not available in ordinary alkaline cleaners. Magnus 24-S is recommended on all steel parts for fast, effective cleaning and rinsing.

Removing Lacquer from Rejects Inspection rejects of plated cases, compacts, etc., call for effective lacquer removal without attack on the copper or brass. You can be sure of quick, effective removal without danger to the metal when you use Magnus 755. It's completely safe for *all* metals.

Cleaning after Deep Draws The metallic soaps formed by the heat of the draw form very stubborn deposits, not readily removed by alkaline or solvent cleaners. The Magnusol-Mineral Spirits mix makes a perfect cleaner for these deposits. It's safe for any metal, and it removes not only dirt, but all fine metallic particles — a particularly useful function between draws.

Cleaning Die Castings before Plating You can't use ordinary alkaline cleaners because they spangle, etch or corrode these metals. Yet before plating you must use an alkaline cleaner to get the chemically clean surface you need for good results.

Magnus 92 CK is *safe*, fast and effective, and because it's a *liquid*, it leads to faster and more accurate making-up of solutions.

There's a Magnus Cleaner specially designed to do the job on practically any operation on which you are having trouble. Give us the details. We'll make a recommendation.

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Without Buffing

REFRIGERATOR TRAYS

PROBLEM: The plating methods being used by a manufacturer of refrigerator trays were failing to produce the smooth, lustrous finish essential in such a product. The only alternative, a separate buffing operation, would prove expensive and difficult because of the shape of the product.

SOLUTION: By converting to Daybrite, this manufacturer was able to secure a quality finish on his products, possessing the desired lustre and smoothness. The dense, smooth Daybrite deposits, which tend to level out minor defects in the base metal, completely eliminated the need for costly, time-consuming buffing operations.

USING Daybrite

THE IMPROVED ACID COPPER BATH

• Want greater productive output and lower production costs in your plating department? Then check right now on Daybrite, the improved acid copper bath.

Here's faster plating speeds—up to .001 in 10 minutes . . . smooth, dense deposits that help simplify or completely eliminate buffing operations. Daybrite requires no ventilation . . . it's fast, safe and costs less to maintain.

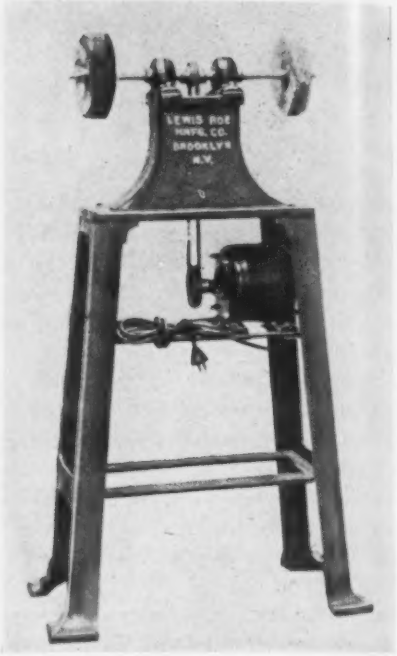
The complete Daybrite story will interest you . . . write today, outlining your plating requirements.

✔ CHECK THESE DAYBRITE ADVANTAGES:

FASTER PLATING—Plating speed up to .001 in 10 minutes.
LEVELING ACTION—Tends to eliminate minor defects in base metal.
NO VENTILATION REQUIRED—No objectionable fumes or odors.
ROOM TEMPERATURE BATH—No hot solutions used with Daybrite.
REDUCED MAINTENANCE COSTS—Daybrite replacement chemicals cost less.
SAFE, CLEANER—No cyanide is used in Daybrite; deposits require no activation.
COMPLETE SERVICE—From analysis of your plating requirements to final installation and job set-up, Daybrite service is complete.

Daybrite is adaptable to electroforming operations, as proven in the recording industries, where Daybrite's inherent fine grain and tensile properties are especially beneficial.

Dayton Bright Copper Company
1030 VALLEY STREET • DAYTON 4, OHIO



down at the ends to ½" diameter and threaded eight square threads to the inch. The spindle is tapped for taper points furnished with the machine.

A switch, eight feet of cord, a V belt and a device for keeping belt at a uniform tension are also furnished. Machine weighs approximately one hundred pounds and can be moved about the shop. Electric current to operate machine costs approximately one cent per hour.

Temperature Control for Cooling Water Systems

Sarco Company, Inc., Dept. MF, 350 Fifth Ave., New York 1, N. Y.

A new design of self-operated, rigid-stem type temperature regulator for limiting the flow of cooling water thru engine and compressor jackets, hydraulic presses, vapor degreasers, condensers, etc., to maintain constant temperature has been announced by this firm. This control is of the type where the warm water flows over the bulb which is rigidly attached to a valve in the cold water supply, piped to the bulb location. Special features are:

Closely balanced, double seated valves provide accurate control without danger of sticking or chattering.

A separable socket allows regulator to be removed for inspection without interrupting operation.

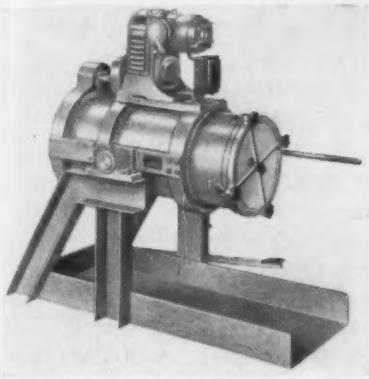
Large capacities—low cost—compact installation (no flexible tubing).

Sizes ⅜" to 1½" for water pressures to 150 psi.

Variable Speed Burnishing Barrels

Belke Manufacturing Co., Dept. MF, 947 N. Cicero Ave., Chicago 51, Ill.

Increased efficiency in burnishing on widely varied jobs is provided by



an improved series of Belke burnishing barrels equipped with variable speed drives.

The variable speed drive is mounted on top of the barrel where it is conveniently accessible for speed adjustment, yet stays dry and is out of the way. Critical adjustment to any rotating speed from 13 to 39 RPM is made by turning the small hand crank. Other speed ranges based on a 1 to 3 or 1 to 4 ratio can be furnished if specified.

The barrels are accurately balanced for easy tilting. A spring pressure ratchet lock, operated by a foot lever, holds the barrel securely at any angle. Patented bearing construction provides smooth running with capacity or smaller loads. The aluminum cover is light-weight and self-sealing.

Belke barrels are available in three sizes. They can be furnished with either hard maple or rubber lining, or with steel ribs welded to the inside surfaces of the barrel.

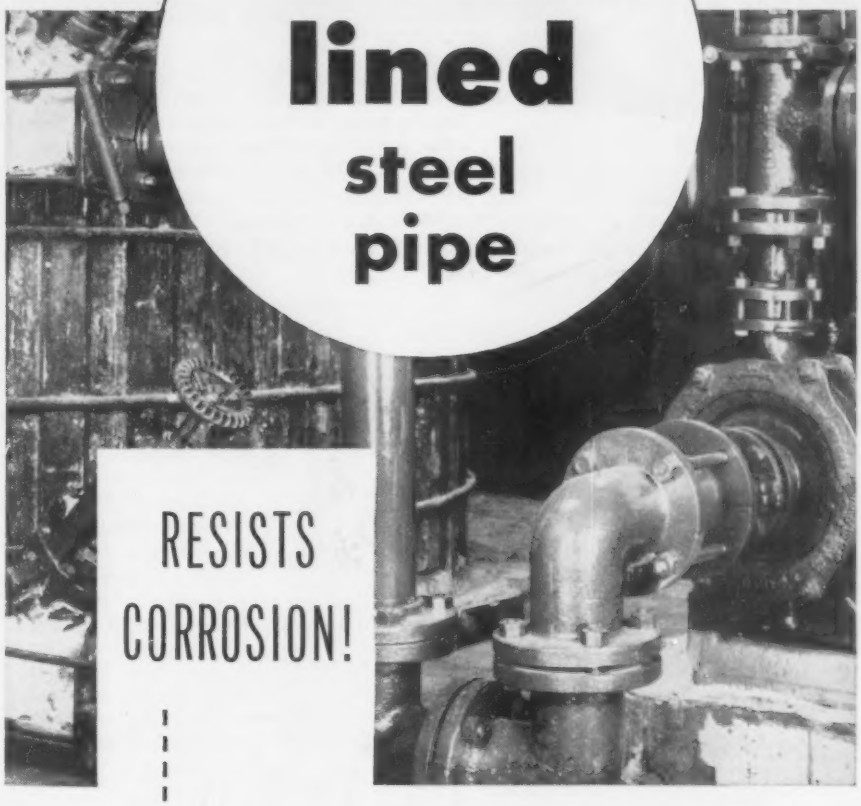
Complete information furnished on request.

New Plating Rack Coating

The Hanson-Van Winkle-Munning Co., Dept. MF, Matawan, N. J.

The development of Kote-Rax Grade K, a rack coating designed to insulate and protect plating racks and fixtures in all types of electroplating and anodizing solutions, has been announced by this firm. This formulation has excellent chemical resistance and is free from any tendency to introduce organic impurities into bright plating solutions, it is claimed.

saran lined steel pipe



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reduces shut-downs!
readily field-fabricated!
available immediately!
lower in cost!

Saran lined steel pipe is available in maximum lengths of 10 feet and in sizes from 1 to 4 inches inclusive.

Also available are saran lined plug valves, flanges, reducing flanges, flanged fittings, gaskets and fittings with union ends.

Write us today for further information concerning saran lined steel pipe and how it may solve your problem.

Manufactured by The Dow Chemical Company, distributed nationally by Saran Lined Pipe Company.

SARAN LINED PIPE COMPANY
702 Stephenson Building • Detroit, Michigan

Offices in: New York • Boston • Philadelphia • Pittsburgh • Chicago • Tulsa • Indianapolis • Houston San Francisco • Los Angeles • Portland • Cleveland Denver • Seattle • Toronto

DOW
CHEMICALS INDISPENSABLE TO INDUSTRY AND AGRICULTURE

SPECIAL OR STANDARD

MAGNUS CAN PROVIDE THE CLEANING MACHINE BEST SUITED TO YOUR OPERATIONS

Your cleaning job may best be carried out on the flexible, speedy turnover basis of the standard batch-type Magnus Aja-Dip Machine, with or without accessory Magnus Hot Dip, Soak or Rinse Tanks and Dryers.

It may call for fitting your cleaning operation into the production line, with specially designed Magnus Machines.

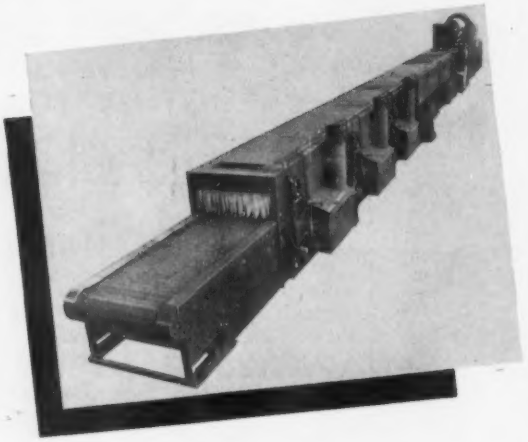
Magnus plays no favorites. We can supply the machine best suited to your particular operations.

STANDARD

This installation is based on the #5 Magnus Aja-Dip Cleaning Machine, four Magnus #5 Hot Dip Tanks and one #3 Magnus Dryer.

It does 10 times the work of a former vapor degreasing installation at less than half the cost in removing oil and drawing compounds from a wide range of steel parts prior to heat treating and/or enamelling.

SPECIAL



This eight-stage special Magnus Cleaning Machine is used for cleaning steel parts prior to vitreous enamelling. The eight stages include alkaline washing, rinsing, acid pickling and hot air drying.

The right Magnus Cleaning Machine for your operation will cut plenty of time, labor, cleaner cost and rejects from your over-all costs.

MAGNUS CHEMICAL COMPANY • 11 South Ave., Garwood, N. J.

IN CANADA—MAGNUS CHEMICALS, LTD., 4040 Rue Musson, Montreal 36, Que.

Service representatives in principal cities

IN METAL CLEANING IT'S Magnus

CLEANERS • EQUIPMENT • METHODS

The application procedure is rapid and simple. Only two dips are required to obtain a final coating which is equivalent to ten or more dips of other solvent-dispersed vinyl materials, because Kote-Rax Grade K is 100% solids whereas other materials are often as high as 90% in solvent content.

This new rack coating belongs to a group of compounds commonly called plastisols, the best in plating rack protection now available, according to the firm. In applying the coating, sharp edges should be rounded, although this is not as important as with air dry coatings, and the surface should be clean and dry. Mechanical (sandblasting) or chemical (acid pickle) etching is helpful. Apply one coat of Kote-Rax Primer by brush or by dipping and air dry for half hour.

Dip the cool rack into the Kote-Rax Grade K, twisting to dislocate clinging air bubbles and to assure full coverage. Draw rack from dip tank slowly and allow to drain for 15-20 minutes. Trim excess with rod or knife and bake at 350°F. for 10 minutes. Dip immediately in Kote-Rax, allowing the rack to remain therein until the heat of the rack builds up the required coating thickness, usually 2-5 minutes, withdraw slowly, draining and trimming as before; finally baking at 350°F. for approximately 15 minutes. Trim contact points with sharp knife, and the rack is ready for use.

Finish for Aluminum Reduces Polishing

Chemclean Products Corp., Dept. MF, 64 Sixth Ave., New York 13, *N. Y.*

Chemlustre, a new finish for aluminum, has been developed by this firm. This finish is recommended for the following purposes:

1—Giving badly weathered aluminum a uniform and bright appearance.

2—Bringing aluminum articles to a highly lustrous semi-satin finish. Applicable to many jobs where pleasing appearance is required but where mechanical operations such as polishing, etc., would be too costly.

3—In many applications where aluminum is to be anodized, several or all mechanical operations such as polishing, etc., can be eliminated.

By the elimination of many expensive wheel operations, this process will make it possible to produce a variety

of work which was formerly impracticable because of excessive costs.

The material involved in the Chemlustre process is an alkaline combination white and crystalline in appearance. It is used in ordinary steel equipment, preferably with an exhaust system similar to that used in chromium plating.

The simplicity of the operations is clear from the following directions for use:

Concentration: 2 to 4 pounds per gallon of water.

Temperature: 160° to 180° F.

Immerse work from 15 seconds to 2 minutes in the solution. Follow immediately with a rinse in cold running water.

To remove smut, use either Chemclean No. 540 or 50-50 nitric acid at room temperature.

The lustre of the work will depend upon the alloy and the time of immersion.

Pickling Acid for Steel

Nielco Laboratories, Dept. MF, Detroit 19, *Mich.*

Nielite D pickling acid is a compound acid produced from a phosphoric acid base. It contains neither sulphuric or hydrochloric acids, and is put up in a concentrated liquid ready for mixing with water.

The acid can be employed at the ratio of 1 to 3 (25% acid) or at the ratio of 1 to 4 (20% acid), and should be used heated to about 185°F.

At a concentration of 1 to 3 at 185°F it will remove mill scale from 10 gage hot rolled steel on a five minute cycle, as fast as a 10% sulphuric acid pickling solution, it is claimed. When used 1 to 4 will remove the scale in about eight minutes when heated to about 185°F.

This pickling acid does not give off fumes that will destroy adjacent equipment, nor are there any fumes harmful to the health of the workmen, it is claimed.

Nielite D pickling acid includes effective inhibitors, according to the firm.

Water Soluble Rust Preventive

Stuart Industrial Service, Dept. MF, 166 *W. Jackson Blvd., Chicago* 4, *Ill.*

A new bulletin just issued by this firm describes their Rustex No. 2, a water soluble powder useful for preventing the corrosion and rusting of steel surfaces. A sample envelope of the material is included for actual trials. The manufacturer claims that the powder can be added to soluble oils, grinding solutions, and wash tanks, and that the film left on the parts is imperceptible. One oz. of the powder for each gallon of solution is recommended. Copies of the bulletin and sample quantity of the powder are available by writing to the above address.

Abrasive Belt Lubricant

Gerell Mfg. Co., Dept. MF, 3523 *King Ave., Cleveland* 14, *O.*

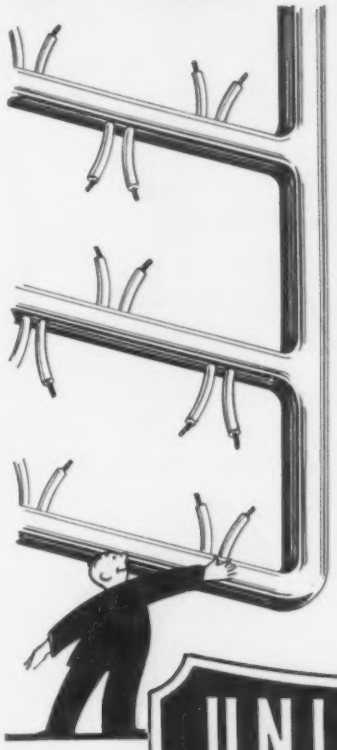
Announced by this firm is a new self-emulsifying lubricant for use on coated abrasive belts that is claimed to eliminate loading and promote faster cutting, smoother finishes, and longer belt life. The material is water soluble, thus effecting rapid cleaning prior to plating operations, and is conveniently applied to the belts from a tubular container. In addition to this material, this firm also manufactures a complete line of polishing and buffing rouges, tripolis, greaseless compounds, liquid abrasives, and wheel cements.

Hydro-Finish Abrasive Blasting

Pangborn Corp., Dept. MF, Hagerstown, Md.

Hydro-Finish a modified form of impact blasting with an abrasive suspended in liquid, is now available from the above firm. This new devel-

TWICE THE WEAR AT HALF THE COST!



Unichrome Coating 218 cuts expenses for one of the country's largest platers!

With their tremendous plating operation, this company has really been able to put Coating 218 through its paces, under every plating room service. They discovered that Unichrome Coating 218 gives better than twice the service life of former coatings, costs less than half per rack...and reduces rack maintenance by 50%!

It will pay you to investigate the substantial savings possible with this flexible, baking synthetic. It resists all plating solutions, contains 100% solids (all *working* material—nothing lost to thin air). It forms a glossy, heavy coating that cuts dragout, resists damage. Why not write for our bulletin RC-1 for more details?

If you have no baking facilities, there are local applicators who will cover your racks with Coating 218.

UNICHROME

Trade Mark Reg. U.S. Pat. Off.

RACK COATINGS—Products of

UNITED CHROMIUM, INCORPORATED • 51 E. 42nd St., New York 17, N.Y.

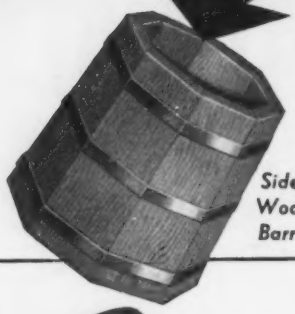
Detroit 7, Mich. • Waterbury 90, Conn. • Chicago 4, Ill. • Dayton 2, Ohio • Los Angeles 13, Cal.

Put Your FINISHING PROBLEMS

IN A

HENDERSON

TUMBLING BARREL

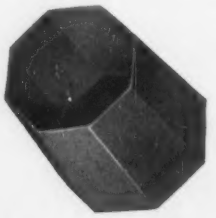


Sided Wood Barrel

For nearly ¾ of a century HENDERSON BROS. has been helping manufacturers solve their Tumble Finishing problems with a wide variety of Tumbling Barrels . . . Sided Wood Barrels, Round Wood Barrels, Perforated, Cast Brass, Cast Iron, Welded Steel Barrels and Rubber Lined Barrels in the Tilt type and Horizontal Type for Bench and Floor installations. Where special processes call for special barrels, Hendersons is prepared to design and construct Tumbling Equipment to customer specification.

Write us, outlining your particular problem. Our Engineering and Development Service will be glad to make recommendations.

Perforated Tilting Barrel



Welded Steel Barrel - Polygonal

Since 1880 Designers and Builders of Tumbling Barrel Equipment.

THE HENDERSON BROS. COMPANY

135 S. LEONARD ST., WATERBURY, CONN.

opment differs from existing blast cleaning in that extremely fine mesh abrasives can be used making possible the blast cleaning of precision machined parts and holding within tolerances as close as .0001 of an inch, according to the firm, and there is no breakdown of sharp edges and corners. Delicate instruments, wristwatch cases, watch and clock gears, cameras and fragile materials have been cleaned and polished successfully. Many companies are adapting the process for finishing cutting tools after the finish grind, it is claimed.

The process is easily and economically accomplished in a watertight cabinet provided with a hopper tank for mixing, storing and recollecting the suspension. A circulating pump delivers the liquid to the blasting nozzle and velocity is imparted at this point by an injection of compressed air.

Engineers say there is no limit to the fineness of the abrasive particles. Material as fine as 5000 mesh equivalent is already in common use. By varying **particle size,** particle hardness, air pressure, distance of gun from work, and liquid-abrasive ratio—or any combination of these factors—almost an infinite number of finishes and uses are possible, it is said.

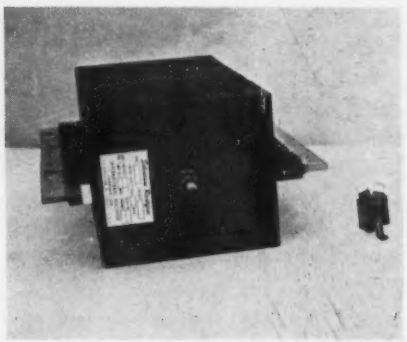
Hydro-Finish can be used to great advantage for deburring, finishing threaded sections, surface finishing and lubricating control, and removal of directional grinding lines, heat treat scale or discolorations, it is claimed, and the method is ideally suited for use in preparing surfaces for electroplating, painting or enameling and in the manufacture and maintenance of forging dies, die casting dies, rubber and glass molds, according to the firm.

Hydro-Finish cabinets are available in four sizes—requiring floor space of 30″ x 36″, 48″ x 36″, 72″ x 60″, and ranging from 7′10″ to 10′9″ in height.

Moisture-Proof Rectifier Stacks

International Rectifier Corp., Dept. MF, 6809 *S. Victoria Ave., Los Angeles* 43, *Calif.*

The selenium rectifier stack shown



features a special moisture-proof finish capable of withstanding salt spray, such as encountered in naval and seashore installations, for periods up to 200 hours, according to the firm. This special protective finish is obtained by a triple dipped coating process and is especially recommended for service under adverse atmospheric conditions such as high humidity, tropical climates (where fungicidal corrosion is likely), corrosive fumes (such as electroplating), etc.

The rectifier plates are made in six different sizes ranging from 1¼" x 1¼" to 6¼" x 7¼", the latter size being the largest selenium rectifier plate commercially available in the United States, it is claimed. D.C. power requirements from two volts and 150 ma. to 5000 volts and 10,000 amperes (and above) can be handled with efficiencies varying from 65% up to 85%, depending upon the circuit employed. Each plate is rated at 26 volts rms. inverse voltage.

"Karbate" Heat Exchanger

National Carbon Company, Inc., Dept. MF, 30 East 42nd Street, New York 17, N. Y.

Recently announced is a Karbate seven-tube impervious graphite shell and tube heat exchanger, Series 70A, as a redesign of the previous Series 70, thus augmenting the usefulness of this exchanger. The basic elements of the new unit may be converted from a single pass to a double pass unit by a simple change of covers. The exchanger can better be adjusted to varying rates of flow and amounts of liquid handled. This feature gives the unit added utility without affecting its original efficiency, it is claimed.

Replacement of tubes may now be made quickly and easily in the field, thus eliminating the necessity of blocking off tubes and thereby reducing capacity. Two sizes, having effective outside tube areas of 16.4 sq. ft. and 24.6 sq. ft. are carried in stock.

Pre-Plated Nickel Coated Wire

Kenmore Metals Corp., Dept. MF, 80 Broad St., New York, N. Y.

Recently announced by this company is a line of pre-nickel plated steel wire, available in gauges from 5/16" in diameter to No. 40 gauge. Coils up to 300 lbs. in weight are standard, and the wire is available with a satin or a bright finish. In addition to nickel plated steel wire, the firm also is in a position to supply copper and brass plated steel wire, and nickel and silver plated copper wire, as well as chrome plated rods. The company claims that bending and forming operations will not destroy the bond between the nickel and the base metal, and that manufacturing wire parts from pre-plated wire will eliminate a nuisance job in most plating departments. Further information is available on request.

Your Key

To Greater Polishing Profits

Even in a Buyer's Market!

GRIPMASTER
PATENTED
POLISHING CEMENT

- ✓ LONGER WHEEL HEAD LIFE! Up to 47% more pieces per head! Thanks to Gripmaster's special high-heat resisting ingredient!
- ✓ FEWER STOPS FOR WHEEL CHANGES! Gripmaster *locks in* grains of emery "vise tight!"
- ✓ INVENTORIES SIMPLIFIED! One grade grips *all* grains—300 to 20!
- ✓ GREATER FLEXIBILITY gives more and finer "breaks" when wheel is "cracked!"
- ✓ NO DETERIORATION! NO OBNOXIOUS ODORS!
- ✓ IDEAL ON *ALL* METALS . . . ferrous and non-ferrous . . . on plastics, too!

WITH a buyer's market definitely on the way, it's time to find out how you can increase your polishers' efficiency, reduce costs, produce better finishes. GRIPMASTER gives you the key. Here's how:

Mail Coupon Now!

"First Choice of the World's Best Finishers"

GRIPMASTER DIVISION
NELSON CHEMICALS CORP.
12345 Schaefer Hwy. Detroit 27, Mich., U.S.A.

IN CANADA:
H. C. Nelson Chemicals, Ltd.
Windsor, Ontario

☐ Send us a generous FREE SAMPLE of Gripmaster.
☐ Send us data on how to boost polishing production.

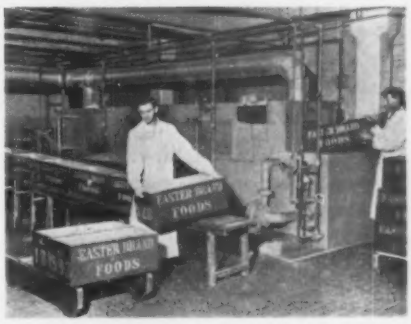
MF 349

COMPANY_____
ATTENTION_____
ADDRESS_____
CITY_____ STATE_____

Conveyor Type Washing Machine

Cincinnati Cleaning & Finishing Mach. Co., Dept. MF, Ironton, O.

The above installation photograph, taken at the Danahy Packing Company, Buffalo, New York, illustrates a new belt conveyer type wash and rinse machine developed by the above firm. This machine automatically cleans containers which heretofore had been cleaned by hand. Several men were eliminated from this operation, and as a consequence, labor costs were reduced proportionately, it is claimed. In addition, the cleaning compound cost has dropped due to more efficient operation. This is a very simple type



machine and is not equipped with any unnecessary gadgets. The unit is built in several sizes, depending upon the requirements for production, heat, etc. "Cincinnati" solution recirculating system is included. Complete details on request.

SPARKLER
horizontal plate
FILTERS

SPARKLER horizontal plate FILTERS

Good Plating Requires Clean Plating Solutions

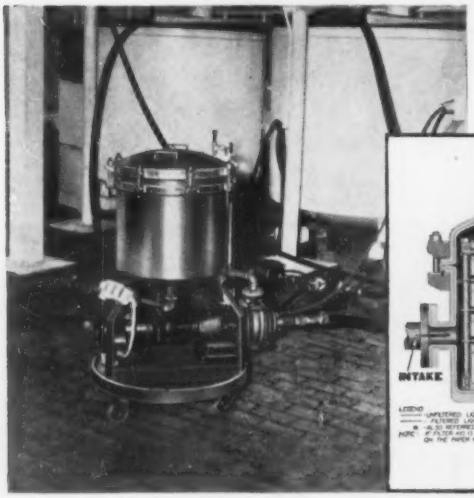
Sparkler Horizontal Plate Filters effectively remove all solids and precipitates from plating solutions—provide positive assurance that solutions are free from undesirable matter.

The horizontal plate principle used by Sparkler makes possible the formation of firm, stable filter cakes that will not slip or crack under intermittent or continuous flow. Flow through the filter is always *with* gravity, and filter aid is floated into position, forming a firm cake of even thickness.

The accompanying photograph shows a typical Sparkler installation in a modern plating plant. Previously, in this plant, silver chloride slurry was shoveled into crocks and laboriously washed by decantation. Now, chloride is mechanically agitated, collected, and washed in the Sparkler filter. Cost of the operation has been sharply reduced and quality of the chloride has been greatly improved.

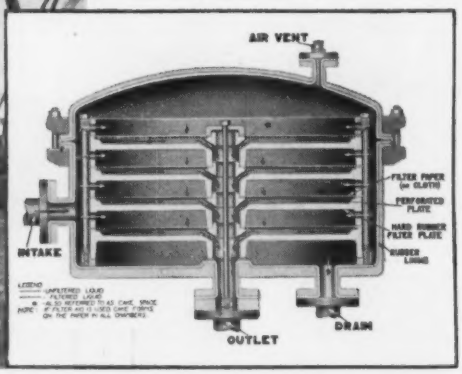
Filters are pressure-tight and leakproof, and are available in rubber-lined construction, stainless steel, or iron. Capacities from 60 to 10,000 G.P.H.

Our Engineering Service is available for your specific problems.



SPARKLER MANUFACTURING CO.
MUNDELEIN, ILLINOIS

This Sparkler Filter is used by a large silverware manufacturer in connection with the plating of silverware.



Coated Fabric Gloves

Surety Rubber Co., Dept. MF, Carrollton, Ohio.

Development of a new coated fabric work glove that is claimed to outdo rubber and all standard synthetic coated gloves, both in resistance to chemicals and resistance to abrasion, is announced by the above firm. The new gloves will sell for the same price as standard oil-resisting synthetic coated gloves.

The difference between the new glove and coated fabric gloves now on the market lies in the coating which was developed after hundreds of compounds had been made and tested, according to the firm.

The manufacturer says that the new coating surpasses rubber, and all

standard synthetics, in resistance to virtually all industrial chemicals, including acids, alkalis, oils, petroleum hydrocarbons and sovents, alcohols, ethers, esters, hydraulic fluids, refrigerants, plating solutions, and a host of others.

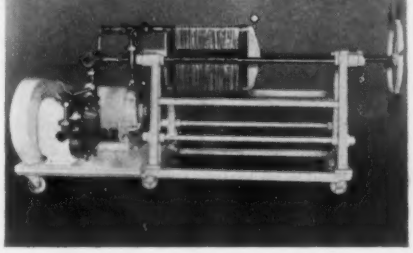
The manufacturer also reports that the new glove shows higher resistance to abrasion in both laboratory and field tests. The coating on the glove is thick and pliable, providing adequate cushioning.

Available in knit wrist, band-top, and 12″ and 14″ gauntlet types. All types are jumbo size, with curved fingers.

New Stainless Steel Filter

Ertel Engineering Corporation, Dept. MF, 22 Front St., Kingston, New York.

This firm announces the development of a new plate type filter unit where all parts coming in contact with the liquid are stainless steel. The unit incorporates a sanitary stainless steel



pump and is equipped with stainless steel sanitary fittings. Sight glass allows view of liquid clarity.

Closing of the filter is effected by the single effortless handwheel. A stainless steel drip pan is provided to save valuable liquids. Pressure gauge indicates working pressure at all times and pressure relief valve is standard equipment for complete safety. This filter is built in sizes to accommodate from 10 to 100 low iron and calcium asbestos filter sheets, filter paper or filter cloth.

Capacity from 5 to 30 gpm. Easy mobility is assured by six casters. The combination of polished stainless steel and white enamel make this filter highly adaptable to installation in all sanitary production lines.

Portable, Self-Contained Dust Collector

Aget-Detroit Company, Dept. MF, 353 Main at Washington, Ann Arbor, Mich.

Designed and built especially to collect dust, dirt and lint from medium

size, grinding, buffing, polishing operations, the Model 800 Dustkop is added to its line of unit type industrial dust collectors by the above firm.

Except for size and capacity, the new model is identical with previous models and develops a rated 746 cfm at 8,000 fpm velocity, with 3.7" water lift and employs the same principle of operation as its predecessors in the line: A paddle wheel, self-clearing fan, direct driven by a continuous duty, ¾ h.p., 3600 r.p.m. motor, creates the suction to remove the dust from the source. A cyclone separator, self-contained within the unit removes the majority of the dust and dirt from the air stream allowing only the extreme fine dusts to be trapped by the spun glass filter which forms the top of the unit and comprises a second stage cleaning for the air before it is recirculated to the working space to save heat.

Dust and dirt removed from the air stream in the cyclone are deposited in the removable drawer of the dust collecting bin which forms the base of the unit. The fine dusts which are removed by the non-inflammable spun glass filter are quickly shaken out of the filter by a hand crank. On average installations, shake-down of the filter is required infrequently.

Compactness (20" x 30" floor space x 30" height) permits the unit to be installed immediately behind or close to the source of the dust. Inlets sized for connection with standard sheet metal pipe or flexible metal hose are optional as follows: Single 6", single 5", double 4". Installation requires no wall, floor or roof cutting, nor any duct work usually anticipated with the collection of dusts.

RELIEF FROM RACK EXPENSE

Rack upkeep can assume large proportions and become a major cost item. A large portion of this rack expense can be avoided through the use of semi-permanent insulation such as BUNATOL No. 1000 Paste. This very thick and exceedingly tough coating will stand up for months and oftentimes last as long as the rack is to run. That makes a real saving in rack costs. No. 1000 Paste insulation is all solids and contains no evaporating liquids: no waste, no loss. Easy to handle and the cost per rack is much less because of less labor and time and much lower material cost. Just a quick oven bake and the heavy coating becomes a part of the rack with several times the wear life at less than half the cost. If you do not have an oven, our applicators can handle your racks. Write for information.

NELSON J. QUINN COMPANY TOLEDO 7, OHIO

TECHNICAL LITERATURE

Effects of Copper in Nickel Baths on the Salt-Spray Resistance

Research Report No. 13—Published by the American Electroplaters Soc. P. O. Box 168, Jenkintown, Pa. Price 40 cents.

Experimental data is shown to substantiate the claims that copper as an impurity in nickel plating baths lowers the resistance to salt spray of both nickel and nickel-chrome coatings. In a Watts bath containing 10 milligrams per liter of copper the salt spray resistance was reduced by 25%, with corresponding decrease at higher copper concentrations. This research is continuing and further results will be reported at a later time.

Physical Properties of Electrodeposited Nickel

Research Report No. 12—Published by the American Electroplaters Soc. P. O. Box 168, Jenkintown, Pa. Price 65 cents.

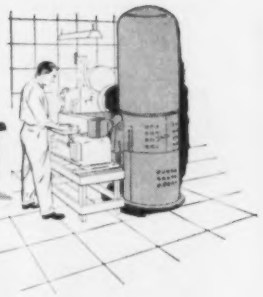
This booklet is in the nature of a progress report on the current research being conducted on the overall problem of the physical properties of all electrodeposited metals by The American Electroplaters Society. This report covers nickel deposits obtained from a variety of plating baths, including all-sulfate, Watts, high-sulfate Watts, Sulfate-chloride, all chloride, and chloride acetate. Properties studied and reported on are hardness, tensile strength, electrical resistivity, microstructure, at various bath concentrations, current densities, and pH.

Business Items

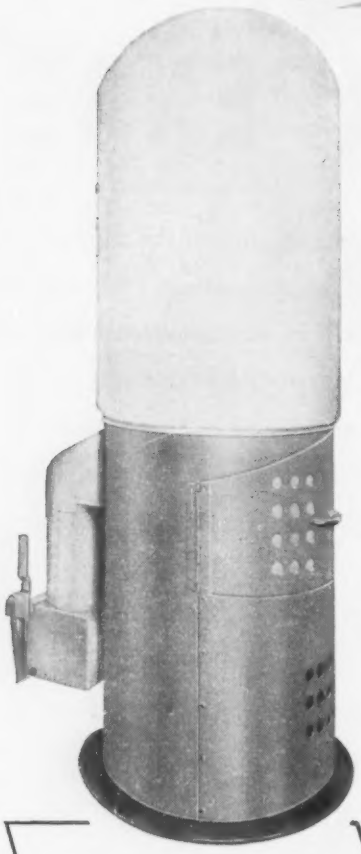
Tramer Appointed Distributors for Copper-Core Lead Anodes

The Gilbert Tramer Co., of 402 Swetland Bldg., Cleveland, Ohio, have recently been appointed national distributors for the Hartzell "Copper-

...PUT IT WHERE YOU WANT IT



The KIRK and BLUM Self Contained Dust Control Unit



● The new KIRK & BLUM Self-Contained dust control unit can be set up anywhere to serve a machine for any period of time.

These new units eliminate the need for long, costly pipe runs to remote areas of the plant where one or a few machines are located. These units collect shavings from one to four machines.

The KIRK & BLUM Self-Contained unit is entirely different and more efficient than smaller conventional units . . . not a cheap fractional H.P. product designed to a price.

This unit will do a fine job of dust collecting, handling of dust and shavings of wood working machines; grinding, buffing and polishing from metal working machines and similar dust sources.

Made by KIRK & BLUM, experts in dust control for over 40 years, your guarantee of complete satisfaction. Write for new booklet on this Self-Contained portable dust control unit. The Kirk & Blum Mfg. Co., 2859 Spring Grove Ave., Cincinnati 25, O.

Powered by a 3 HP motor. Has an air volume of 900 CFM at 2" suction with capacity for four 3", two 4" or one 6" pipe connection.

Copyright 1948, The Kirk & Blum Mfg. Co

FOR CLEAN AIR . . . THE [redacted] TOOL

KIRK AND BLUM
DUST CONTROL SYSTEMS

Core" lead anodes for chromium plating. These anodes are unique in that the copper core extends through the entire length of the anode, thus distributing the current uniformly to all parts of the anode. In addition, these anodes have a design which features many points for good throwing power.

Pennsalt Appoints Graham District Sales Manager

Donald W. Graham has been appointed District Sales Manager of the Heavy Chemicals Division of the *Pennsylvania Salt Manufacturing Co.* to take charge of the Cincinnati Sales Office, it was announced here by *Mr. R. S. Roeller*, Sales Manager of the Division.

Mr. Graham, who has been in charge of Pennsalt's St. Louis office for several years, succeeds Mr. C. W. Dermitt, who resigned early this month. Temporarily, Mr. Graham will combine his duties at Cincinnati and St. Louis.

A native of Prophetstown, Ill., Mr. Graham joined Pennsalt in 1932, a few years after being graduated from business school in Sterling, Ill. He became a salesman for the Heavy Chemicals Division, attached to the Chicago office, in 1935, and went to St. Louis in 1943.

Florida Weather Testing by New York Laboratory

An out-of-doors testing station in Miami, Florida, provides the maximum of exposure to the sun's rays for weather testing of materials and products. Arrangements have been made by *Sam Tour & Co., Inc., 44 Trinity Place, New York,* for such testing service.

This firm of metallurgists, engineers and consultants makes use of these Southern Florida facilities because cloud interference is at the minimum. This permits the maximum of actual exposure to rain, wind and salt water as well as to intense sunshine and makes it possiblt to conduct weather exposure tests on a year round basis.

At their laboratories in New York City facilities are maintained for both outside and inside weather testing. Outside testing racks are set up on the roof of their building while in the laboratory simulated weather conditions are secured by up-to-date equipment.

Interpretation of reports on all weather tests are made by the engineering staff in the laboratories in New York. Materials and products tested, vary widely. Amongst them are paints, enamels, surface coatings of metals, plastic materials, etc.

Globe Products Announces Promotions

Globe Products Manufacturing Company, Los Angeles, Calif., announces the election of *W. B. Merriam* as President of the Company. Mr. Merriam has previously served in the capacity of Executive Vice-President. *R. E. Lockard* was elected Vice-President in Charge of Sales. Mr. Lockard has been Sales Manager for the past two years.

Thomas O'H. McArdle, formerly with the Lynn Company in Burbank, California, has been selected to head the Contract Division. This division of the company manufacturers parts and sub-assemblies for Aircraft and other industries.

Globe Products manufactures Grinders, Buffers, Hand Screw Machines, Turrets, Cross Slides, Millers for Lathes, Boring Bars and Boring Bar Holders, Dividing Heads and other machine tools and accessories that are distributed internationally.

Clark University Chemists Seek Purer Metal Solutions

Four student chemists in the Graduate Department of Chemistry at Clark University in Worcester, working under the direction of *Dr. Arthur E. Martell* of the faculty, are conducting

Dr. A. E. Martell

a research project involving the synthesis and study of a new series of chemical substances for altering the properties of metal solutions. The students are *Albert E. Frost, Stanley Chaberek, Richard C. Brown* and *Robert C. Plumb*, all of Worcester. All are ex GI's with overseas service and all are seeking higher degrees in chemistry.

The project is being supported in part by grant of funds, chemicals and equipment by *F. C. Beresworth*, who pioneered the industrial development of aliphatic poly amines and their chelating amino acid salts and derivatives. Beresworth is president of the *Beresworth Chemical Co.* of *Framingham, Mass.*, producers of this type of sequestering and chelating agent for industry.

The new substances under study at Clark University are called sequestering or chelating agents. They offset the undesirable properties of certain metals which occur as impurities in water and in many commercial preparations including liquid soaps, fats, oils, emulsions, sanitizing agents, drugs, food products, tetxile and metal processing.

It will pay you to specify *SPEEDIE* Tripoli Compositions . . . For *SPEEDIE* Tripoli assures you a "laboratory-quality" composition. The faster cutting properties of a job-proved *SPEEDIE* Tripoli makes it most economical for buffing aluminum, brass, bronze and copper — die castings and stampings. Small and large shops alike choose among the many popular *SPEEDIE* Tripoli Compositions, ranging from the ever-popular No. 607, to No. 1014 for cutting and coloring in one, fast operation.

You may be seeking No. 1639 *SPEEDIE* Tripoli . . . A "natural" if you are having cleaning problems — *it readily emulsifies in hot water*, eliminating cleaners. If you are using liquid compositions, specify No. 1887 *SPEEDIE* "Spray-It" Tripoli — scientifically blended to stay in suspension. Learn more about the many other *SPEEDIE* products — Nickel Finish, Stainless Steel and Chrome, Grease Stick and Emery Cake — Write Dept. MF for your FREE catalog, today!

Polishing Room Supplies and Accessories

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Cable address: Buckprod

Brown Instruments Appoints New Managers

O. B. Wilson, eastern regional sales manager for Brown Instrument division of Minneapolis-Honeywell Regulator Company, has been named manager of sales for the east, southeast and central regions, it was announced by *L. Morton Morley*, Brown's vice president and general sales manager.

Wilson, who has been with the industrial instruments division of Honeywell for the past 25 years, will supervise sales in the area extending from Florida and the Gulf of Mexico to the Canadian border. He will make his headquarters at the Brown plant in Philadelphia.

Warren W. Matlack has been named industrial manager of the New York City branch.

Matlack, who succeeds O. B. Wilson. has been with the Brown company 18 years and has been the company's district manager at Albany, N. Y., for several years.

Devon W. Fryback has been appointed district manager of the Albany, N. Y. office.

Fryback, who has been industrial manager at Hartford, Conn., has been with the Brown company for the past 21 years.

D. Lyle Russell has been made industrial manager of the Hartford, Conn., district office.

Russell has been transferred from the Boston office of the company.

Herman Hoyler has been named industrial manager of the East Orange, N. J., district office. The New Jersey sales headquarters is now a district office. Hoyler has been with Brown company for 11 years.

Seymour Rejoins Atlas Mineral Products

Mr. George L. Wirtz, president of *Atlas Mineral Products Co., of Mertz-*

MITCHELL-BRADFORD "Package"

One Big

That delivers More than the Goods!

The MITCHELL-BRADFORD "Package" delivers far more than a range of proven metal finishes, heat treating materials and metal cleaners. It gives you an all-inclusive service for setting up and maintaining the most efficient metal finishing and heat treating operations known to modern chemical engineering.

Mitchell-Bradford engineers are skilled in evaluating the needs of a plant. Where specific recommendations are being sought for modern equipment, stepped up production rates, or new, money saving methods, a Mitchell-Bradford engineer is ready with detailed information, facts that will help to make your process more productive. This extra value in the Mitchell-Bradford "Package" ensures a better-than-called-for performance for every one of the well known Mitchell-Bradford products listed below.

BLACKENING PROCESSES FOR METALS

BLACK MAGIC for Steel and Iron
BLACK MAGIC for Zinc, Zinc plate, Zinc die castings and Cadmium Plate
BLACK MAGIC for Copper and its Alloys

METAL CLEANERS

Cleaner #7 Still, soak cleaner
Cleaner #9 Heavy duty soak cleaner
Cleaner #12 Reverse current cleaner
Cleaner #20 Non-etching Aluminum Cleaner
Cleaner #30 Etching-type Aluminum Cleaner
Cleaner #25 Brass Cleaner (non-oxidizing)
Cleaner #66 Solvent Cleaner (emulsion type)
Special Cleaners — formulated for specific applications

HEAT TREATING MATERIALS

QUICK-CARB, #20 — #40 — #60, Liquid Bath Carburizing Salts.
QUICK-TEMPER TEMPERING AND DRAWING SALTS — 275°F. and 420°F. Melting Points.
NEUTRAL SALTS — For Complete Range of Temperatures.

PROTECTIVE FILM FINISHES

WITCH-DIP, Wax Base Compound
WITCH-OIL, Water Displacing Corrosion Inhibiting Oil
FINISH No. 146, Hard Protective Coating and Paint Bond
SILCO — An inorganic, low-temperature bake, vitreous type finish. Rust, acid and abrasion resistant. All colors.

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MODERN METAL FINISHES
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BLACK-MAGIC OXIDE BLACKING SALTS
WITCH-DIP & WITCH-OIL FINAL FINISHES

SILCO *Glass-Base* PROTECTIVE COATING
HEAT TREATING SALTS, CLEANERS, ETC.

town, Pa., has announced that *Raymond B. Seymour*, formerly chief chemist for this firm, has returned as executive vice president and general manager. Dr. Seymour was previously associated with the development of several of the corrosion resistant cements, linings and protective coatings now manufactured by the company and one of his assignments will be the direction of research toward the improvement and development of new protective coatings, linings and cements for the chemical, metal processing, steel, petroleum, rayon, food, paper, leather and textile industries.

In addition to his previous position as chief chemist at Atlas, Dr. Seymour has been associated with the Goodyear Tire and Rubber Company as research chemist, Monsanto Chemical Company as group leader in plastics and rubber research, as director of the Industrial Research Institute of the University of Chattanooga and director of Special Products Research for Johnson & Johnson. He is the author of numerous publications and patents primarily in the fields of plastics, rubber and textiles.

He is a licensed engineer and a member of the American Institute of Chemical Engineers, American Chemical Society, American Institute of Chemists, American Association for the Advancement of Science, American Association of Textile Chemists and colorists, American Society for Engineering Chemistry, American Oil Chemists Society, Alpha Chi Sigma, Sigma Xi and other technical organizations.

Raymond B. Seymour

Optimus Appoints Morris Executive Vice President

Optimus Equipment Co., Matawan, N. J., manufacturers of vapor degreasers, metal parts washers, and pickling and drying equipment, has announced the appointment of *Melville Morris* as Executive Vice President and member of the Board of Directors.

Melville Morris

This appointment follows the recent merger of the Midwestern Manufacturing Company of New York with the Optimus Equipment Company, a subsidiary of the Hanson-Van Winkle-Munning Company.

In line with the enlarged scope of operations Mr. Morris announces the appointment of *Mr. A. Otto Millen* as Middlewest District Supervisor and

the *L. G. Evans Company* as representatives for Illinois, Indiana and Wisconsin.

Grimes New Purchasing Agent for Plume & Atwood

A recent announcement from the *Plume & Atwood Mfg. Co., of Waterbury, Conn.*, confirms the appointmnet of Mr. Charles C. Grimes as Purchasing Agent of their Waterbury Division.

New Firm in Metal Finishing Field

Flurey Products Corporation, 450 *Seventh Avenue* (*Suite* 3500), *New York City*, has recently been organized by *Robert Corey* and *Benjamin S. Flug* to engage in the sale of a complete

Robert Corey

line of products for the polishing and plating trades. Both men were previously connected with the Bart-Messing Corporation in a sales and technical service capacity.

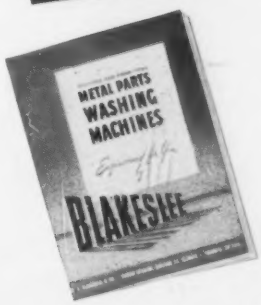
Benjamin S. Flug

Ready for the Finishing Touch!

. . . METAL PARTS ARE MORE EASILY FINISHED WHEN CLEANED IN A

BLAKESLEE

METAL PARTS WASHER



Write today for FREE booklet on Blakeslee Metal Parts Washers to answer your particular cleaning problems.

Whether the finishing operation is enameling, lacquering, machining, plating or inspecting, your washer must do a perfect cleaning job. The Blakeslee Metal Parts Washer is especially adaptable for cleaning between operations and prior to inspection . . . Continuous and batch type metal parts washers are familiar equipment throughout the automobile and aviation industries, as well as all other metal fabrication fields.

G. S. BLAKESLEE & CO.

BLACOSOLV DEGREASERS AND SOLVENT

NIAGARA METAL PARTS WASHERS

G. S. BLAKESLEE CO., CHICAGO 50, ILLINOIS
NEW YORK, N. Y. TORONTO, ONT.

Mr. Corey had extensive experience in plating room problems while with the Union Polishing and Plating Corp. of Rochester. Mr. Flug, a graduate chemist, was formerly with the Calco Chemical Division of the American Cyanamid Corp. and with the Radford, Va. branch of the Hercules Powder Co. Subsequently he was employed as plating superintendent of the Grand Rapids Brass Co. of Michigan.

Flurey Products Corp. is equipped to render complete plating plant layout and engineering service for the polishing and plating trades.

New Firm in Tumbling Field

Announcement has been made recently of the formation of *Clepo Tumbling Specialties*, a division of *American Plating Rack Co.*, at 232 *N. Rosemary Ave., Inkster, Mich.*, for experimental and production tumbling, as well as distribution of a line of tumbling supplies of the leading manufacturers. The firm is owned and operated by *Del W. Dyer*, who has had extensive experience in the tumbling field.

SPIN-DRIES SMALL PARTS *IN 2 MINUTES**

STANDARD MODEL KREIDER DRYER . . . Auxiliary gas or steam heating units available.

Pays for itself in time saved . . .

Dries Faster. Takes as *little* as 35 seconds to whirl parts completely dry—no more than 2 minutes for 50 pounds—drying basket (capacity 1140 cu. ins.) spinning at 625 rpm.

Dries Better. There's no marring or scarring with a Kreider Dryer. It produces smooth, evenly dried surfaces with longer lasting lustre.

Dries More Economically. Simple in design . . . rugged in construction, the Kreider Dryer is operated by one man. Uses less than one hp. Occupies less than 6 square feet floor space.

See for Yourself! Write today to Department M-39 for an illustrated 4-page folder . . . also addresses of installations near you, where you can see a Kreider Dryer in action.

New Holland Machine Co., New Holland, Pa.

***Only 2 simple steps required . . .**
(1) Operator places wire mesh basketful of small parts in Dryer . . . turns motor "ON".
(2) Operator turns motor "OFF" . . . presses foot brake . . . removes basket.

NEW HOLLAND *KREIDER* DRYER

Circo Announces Sales and Service Personnel Change

Mr. John Black, President of *Circo products Co.*, 12117 *Berea Rd., Cleveland, O.*, announces the appointment of *Mr. Norman J. Leary* as Manager of Industrial Sales and Service.

This follows an expansion program of Circo in the industrial field, which has been made possible by the added manufacturing facilities of an entirely new plant.

Having supplied vapor degreasing equipment to the service industries for the past 15 years, Circo is now producing stainless steel machines specially designed to meet the tremendous demand for automatic degreasers of all sizes, by all types of industries.

Mr. Leary, who has had many years of experience in the field of vapor degreasing, is well qualified to carry out his new responsibilities.

Quaker Chemical Appoints Technical Director

The Quaker Chemical Products Corp. of Conshohocken, Penna., manufacturers of metal and textile processing chemicals, synthetic surface active agents, and resins takes pleasure in announcing the appointment of *Mr. W. J. Haring* as Technical Director.

Mr. Haring obtained his Bachelor's Degree in Physical Chemistry at Pennsylvania State College in 1933 and his Master's Degree in the same subject in 1934. He was a graduate scholar in 1934 and 1935 at the Carnegie Institute of Technology.

Mr. Haring has served as a Research Chemist at the W. H. Burns Company, Chief Chemist and Plant Manager with the A. C. Ferguson Company, and joined Quaker in June 1944 as Plant Supervisor, subsequently going into the Control Laboratory, Research Laboratory, and became Director of Metals Research in 1945.

Mr. Haring is a member of the American Society for Metals, Franklin Institute, American Chemical Society, American Physical Society, American Association for the Advancement of Science, and was elected to Phi Lambda Epsilon.

In addition to his professional interest, Mr. Haring is well known for his hobbies concerning obedience training of dogs, hunting, and photography.

Pennsalt Honors Employees

Leonard T. Beale, president of Pennsylvania Salt Mfg. Co., is one of eight employees in the Philadelphia office and the Whitemarsh laboratory who have been honored with pins denoting 20 years of service with the chemical company.

Five employees received honors for 15 years of service, six for 10 years with the company, and 25 for five years' service.

Besides Mr. Beale, those receiving 20-year pins were *A. E. Gaydos* and *Walker Penfield*, Assistants to the Vice President in Charge of Manufacturing; *Erwin C. Adams*, Accounting Department; *T. Bayard Grace*, Purchasing Department; *Allen E. Miller*, Division Purchasing Agent; *William Sagers*, maintenance engineer at the company's Whitemarsh Research Laboratories; and *Cooper Holmes*, electrician at Whitemarsh.

Fifteen-year men honored were *Sydney L. W. Lea*, Manager of Advertising; *Henry G. Meyer*, Assistant Production Manager, Manufacturing Department; *George W. Benbury*, Manager, Packaging and Labeling Division; *Mary G. Kane*, secretary to the General Purchasing Agent; and *Melvin C. Hillwerth* (cq), Accounting Department.

Vincent A. Curll (cq), Technical Advisor, Special Chemicals Division; *Arthur Bixby*, Assistant Sales Manager, Agricultural Chemicals Division; *Albert H. Clem*, Field Sales Supervisor, Special Chemicals Divi-

sion; *Dr. John F. Gall*, Supervisor of Research; *Robert G. Danehower*, Chemical Engineer; and *Norman D. Peschko*, research chemist, all received pins for 10 years' service.

After receiving his own award from *Y. F. Hardcastle*, Vice President in Charge of Manufacturing, who has been with Pennsalt for 40 years, Mr. Beale presented the service pins to the other recipients.

Associations and Societies

AMERICAN ELECTROPLATERS' SOCIETY

1949 A.E.S. Convention News

The Milwaukee Branch of the American Electroplaters' Society has announced the appointment of the Committee responsible for the 1949 National Convention of the Society, to be held in Milwaukee, Wisconsin, June 27 to June 30.

William C. Geissman, 2946 N. 69th St., Milwaukee, has been named Chairman of the Committee. Other members include:

Co-Chairman, Henry Bornitzke; Educational, Leslie Diveley; Finance, Robert Steuernagel; Registration, Frank Marz; Hotel Reservations, Glen Schwemer; Program, Ted Hartshorn; Exhibits, Gene Bosl; Plant Visitation, Omer Doyle; Entertainment, Jack Davis; Hotel, Everett Robinson; Publicity, Vincent Mattacotti; Banquet, Rodney Olsen; Luncheon, Axel Johnson; Outing, R. F. McGuire; Ladies, Mrs. R. F. McGuire.

T. D. Hartshorn is the President of the Milwaukee Branch.

"Plating as a Business" is to be a principal theme of the Educational Sessions of the Convention.

Mr. Leslie Diveley, Chairman of the Educational and Technical Sessions, has stated that in the light of changing economic and market conditions, a series of talks on the business aspects of electroplating will be of immediate interest to all those directly and indirectly connected with the finishing of metals. It is expected that this series will include a statement by a competent authority on the present attitude of the customer toward plated products, as well as a number of informative talks on the availability of plating materials, some of which are presently considered to be in critical supply.

In the past the Educational and Technical Sessions of the Society have been devoted almost entirely to the new techniques and applications of the electroplating and allied processes. Although this practice will be continued at the Sessions in Milwaukee much as in the past, the expansion of the program to include recognition of the economics of the industry places an important emphasis on the 1949 Convention.

Hotel Reservations

To expedite the reservation of hotel rooms for the hundreds of electroplaters and their guests expected for the Convention a special reservation form has been placed in the mail for all members of the Society. Although the Convention is held by the A.E.S., membership in the Society is not a prerequisite for attendance at the Convention. All manufacturers, scientists, and others who have an interest in the finishing of materials by electroplating and related processes are invited to attend.

Since the Hotel Schroeder, which has been named Convention Headquarters, can accommodate only a portion of the expected attendance, the facilities of a number of hotels will be used. Forms for room reservation requests can be obtained from *Mr. Glen Schwemer*, 2610 *N.* 118*th St.*, *Milwaukee* 13, *Wisconsin*, or by writing to the National Office.

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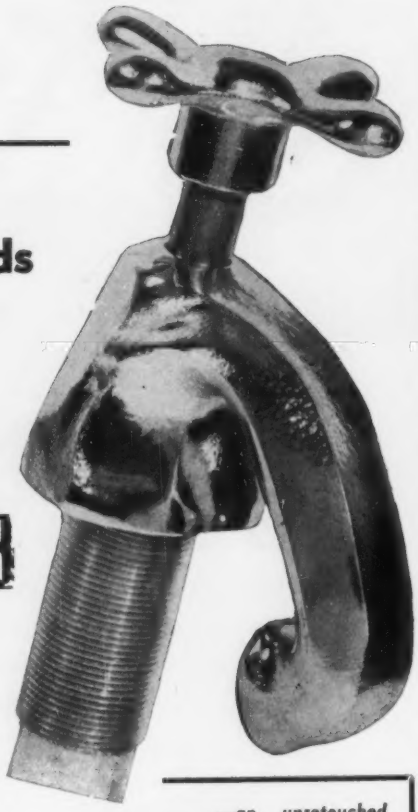
Removal of Buffing Compounds *from* BRASS by PERMAG



—an unretouched photograph of the faucet showing the bent and battered up spout.

Here's a brass faucet, for example, cleaned from all buffing compounds by PERMAG. And to prove that the buffing compound had been removed perfectly, and that the chrome plating would adhere, the faucet was gripped in a vise, hammered and bent as pictured above, AND THE PLATING NEVER SHOWED A FRACTURE OR BREAK AT ANY POINT! After precleaning PERMAG did the electrolytic cleaning job 100 per cent —and because of that the chrome plating was perfect.

Electroplaters who use PERMAG never have trouble with buffing compounds. PERMAG is ready to demonstrate its cleaning power in your plant. Write or 'phone us for a demonstration.

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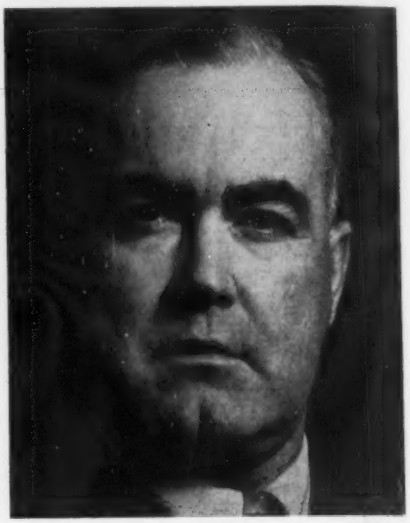
Buffalo Branch

The Buffalo Branch of the American Electroplaters Society at their regular meeting February 4th, had the pleasure of a talk which hit the platers' problems at a different angle, "Galvanic Corrosion." It delved into the why and wherefore of some of the unusual



George W. Cavanaugh

happenings in the plating field, as well as in other fields.

Mr. George W. Cavanaugh, at present head of the chemical section of the Electronics Laboratory, Electronics Park, Syracuse, N. Y., was the speaker.

Mr. Cavanaugh has a Ph.B. degree from Notre Dame, and has done graduate work at St. Bonaventure, and St. Bernards.

The 1949 Northeastern Regional Session and Banquet of the Buffalo Branch of the A.E.S. will be held at the Hotel Markeen, Saturday, May 7, 1949. Educational Session at 2:00 p.m. Banquet at 7:00 p.m.

Subject of the Educational lectures will be the "Purification of Plating Solutions and Demineralizing and Softening of Water by Ionization," covered by three speakers: *Mr. Oscar Stocker,* of Seymour Manufacturing Co., *Mr. Walter Helbig,* of Darco Inc., and *Mr. Harold Faint,* of The Industrial Filter and Pump Mfg. Co.

The speakers are well versed from both the practical as well as the theoretical standpoint, and an interesting round table discussion on filtration and purification is therefore assured.

Indianapolis Branch

The Indianapolis Branch of the American Electroplaters' Society will hold its annual educational meeting at the Indianapolis Athletic Club on April 9, 1949. The educational session will begin at 1:00 P.M. On the program are the following speakers:

Frank K. Savage, Vice President, Graham, Crowley & Assoc., Inc.

J. D. Patrick, Westinghouse Electric Corporation.

G. A. Lux, Oakite Products, Inc.

The evening program includes the banquet, floor show, and dance.

Tickets for the affair are $5.00 per person. For tickets, interested parties should contact *Mr. W. W. Cothran, 7050 N. Pennsylvania St., Indianapolis, Ind.*

Twin City Branch

The Twin City Branch of the American Electroplaters' Society met Monday, February 7th, 1949, in the Lodge Room of the Covered Wagon in Minneapolis. There were 47 members and guests present.

Robert L. Buckley, of Industrial Chemical & Equipment Co., Branch Secretary-Treasurer, led a discussion and lecture on "The Practical Points of Chromium Plating." In addition to his talk, copies of his lecture and miscellaneous tables concerning chrome plating were distributed to those present. Following the lecture, *Ralph B. Maddock*, of Pako Corp., led the round-table discussion on this subject. Considerable interest was shown on behalf of those in attendance.

Following dinner, President *Frank Ireland* introduced the following guests: *Messrs. Crepeau* and *Dean Keller* of Superior Plating and Rustproofing; *Harold Longendyke* of Twin City Chromium Plating; *Wilbur Rahko, H. F. Seibert* and *Henry Makino* of Minneapolis Honeywell Regulator; *Bill Johnson* of Industrial Filter and Pump Mfg. Co.; *John Flekke* of George T. Walker Company; *Ted Daufelt* of American Plating and Polishing Company; *W. H. Soukop* of Owatonna Tool Company; *Quint Hanson* of Superior Plating; and *Waldron Douglas*, Superintendent of the Hennepin County Home School for Boys.

President Ireland named the following Nominating Committee: *E. H. Lindemann* and *G. W. Lillicrop* of Minneapolis Honeywell, *Al Leonard* of

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Iridite is quickly applied manually or automatically, to large or small parts

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√ guards against corrosion on zinc or cadmium—lengthens product life.

√ gives better paint adherence on zinc or cadmium—improves entire finishing system.

√ brightens zinc or cadmium—keeps it bright and shining to help boost sales. Also available in colors.

Whatever your needs in finishing zinc or cadmium, there's an Iridite to do the job. Write today for FREE FOLDER and full information—or better still—send samples of your product for free treatment.

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Specify Kocour Sets from your supplier.

Superior Plating and *Paul W. Felt* of Brown and Bigelow, all four being Past Presidents.

John Anderson of Josten's, Inc., was welcomed into the Branch as this was the first meeting he has attended as a new member.

Following the business meeting, movies of the 1948 Minnesota Football movies were shown by *Phil Brain*.

Boston Branch

The 14th Annual Technical Session and Banquet of the Boston Branch will be held in Boston, Mass., on Saturday, April 16th, at the Hotel Statler, starting at 1:45 p.m. Technical chairman will be *Mr. Arthur Logozzo*, of the Nutmeg Chrome Corp. The technical session will feature the following:

1—A movie in Technicolor, showing the continuous tin plating operations of the Weirton Steel Co.

2—Disposal of Plating Room Wastes, by *Dr. Fred Gurnham*, Chairman, Dept. of Chem. Eng., Tufts College.

3—Levelling of Electrodeposits, by *Myron B. Diggin*, Tech. Dir., Hanson-Van Winkle-Munning Co.

4—Simplified Plating Controls, by *R. O. Hull*, Pres. of the R. O. Hull Co.

Following the technical session will be the annual banquet, with a floor show and dancing for entertainment.

The committee in charge is headed by *Mr. Manson Glover*, of the Glover Coating Co., and includes George P. Swift, Steven Baker, Arthur Collins, Mrs. Anne Baker Love, Mrs. Geo. P. Swift, Walter J. Larrsen, Kenneth Corson, Eugene P. Carter, William L. Meade, James A. Anderson, Leonard Chesworth, and Louis V. Gagnon.

Rochester Branch

The regular monthly meeting of the Rochester Branch of the A.E.S. was held on Friday, January 21st, at the Hotel Seneca, President *Robert Flint* presiding.

The Secretary, *Mr. James Weaver*, announced that the *Green Electric Company* donated a rectifier to the Metal Finishing Class at the Rochester Institute of Technology. It was decided that the Rochester Branch thank the Green Electric Co. for their contribution.

Mr. Berghold made a motion which was approved by the Branch that letters be sent by the Secretary to the firms who donated door prizes for the Xmas Party.

The speaker for the evening was Mr. *Ed. MacAleer*, of the Formax Co., who spoke on "Buffing and Polishing Compounds." Mr. MacAleer's fine talk was well received and promoted much discussion by the members.

Los Angeles Branch

A working-model demonstration of plating solution purification and filtering was presented as the highlight of the educational session of the Los Angeles Branch of the AES February meeting by *Jerry Levy*, of Co-operative Industries, Chester, N. J.

Mr. Levy's talk on "New Materials and Methods for Plating Solution Purification" was given simultaneously with his demonstration. He dwelt mainly on the phase of practical filtration as applied to plating, declaring that there appears to be a woeful lack of knowledge about proper filtration of solutions, a situation which leads many

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Backed by eighteen years experience in the abrasive polishing field, the NIEDERST BACK STAND IDLER offers the utmost in both dependability and productiveness.
Features include:
Bearing Speed Reduced 33%
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Interchangeable Idler
Dual Remote Control Operation
Write for Specification Sheet and information for introducing belt polishing on your present lathe equipment.
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platers to avoid filtering because of the work involved.

He made his demonstrations with a small three-quarter cubic foot demonstration tank, with which he explained how various methods of filtering are accomplished, including treatment with activated carbons. He also demonstrated proper methods for cleaning filters and the membranes.

Donald M. Bedwell, chairman of the 1951 National Convention Committee, reported that the ball had been started to roll by contacts with city officials and the Los Angeles Chamber of Commerce, who had agreed to collaborate on advertising the forthcoming AES convention in Los Angeles through municipal and Chamber of Commerce publicity channels. *Richard Wooley*, convention committee member, reported that as one activity the committee will operate a booth at the 1949 AES convention in Milwaukee as well as at Boston in 1950, at which booklets and California-grown oranges will be distributed. The Program-Directory being published by the branch in conjunction with the 1949 annual educational session, Mr. Wooley reported, is expected to produce approximately $1800 in profits, which will be set aside as the nucleus of a fund to be accumulated to finance the 1951 national conclave.

New members initiated at the February meeting included *Walter Luitjen*, of Bowman Chemicals, Inc.; *Michael Kadish*, of Southwest Plating Co.; and *Jack C. Stone*, of Los Angeles Chemical Co.

The following visitors were introduced: *Joseph Darling, Richard Abcard, Joseph Bell, Otto Jacobsen* and *Don Johnson*.

Annual Educational Session

The 19th annual educational session and dinner dance of Los Angeles Branch of the American Electroplaters' Society will be held at the Los Angeles Breakfast Club on Saturday, March 19.

A program has been arranged which includes morning and afternoon technical meetings, a noon-day luncheon session, and the annual dinner and ball in the evening.

A well-balanced schedule of speakers has been arranged for, including a number of eastern and mid-western authorities on plating and finishing subjects, as well as prominent speakers from the West Coast.

An exhibit of plated products will be shown in booths sponsored by Los Angeles area manufacturers and job plating shop operators. Arrangements have been made for approximately 150 to attend the technical sessions and 400 the banquet and ball.

NATIONAL ASSOCIATION OF METAL FINISHERS

Chicago Electro-Platers Institute

A combined session of the members of the Chicago Electro-Platers Institute and the Finishers Trade Institute was held on January 20th. The event was the 14th Annual Meeting of the Chicago Electro-Platers Institute, and election of their officers and directors was the only order of business.

The recommendations of the Nominating Committee were unanimously adopted, so the following is the current

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George Westerberg, Jr.—Mechanical Plating Company

DIRECTORS—1950

John J. Bognar—Metal Processing Company

Louis P. Lanz—Northwestern Plating Works

Louis Presecky—Quality, Inc.

The new Chairman, J. P. Malooly, complimented the retiring chairman, *Mr. W. O. Zinn* on his untiring efforts in behalf of this Institute, and on his continuing activities with the *National Association of Metal Finishers*, of which he is Director and Secretary. A rising vote of thanks was given Mr. Zinn.

The 57 persons present from the enameling and plating job shops of Chicago then devoted themselves to renewing old friendships and enjoying an evening of relaxation and entertainment.

NATIONAL ASSOCIATION OF CORROSION ENGINEERS

Inter-Society Corrosion Committee

Fifteen delegates and three observers from technical organizations concerned with corrosion met at A.S.T.M. headquarters, Philadelphia, Pa. to formulate the organization of the Inter-Society Corrosion Committee of The National Association of Corrosion Engineers. A plan of organization proposed by *Sam Tour*, Sam Tour & Co., Inc., A.S.T.M. delegate, was adopted. *F. L. LaQue*, president of N.A.C.E., acted as chairman of the meeting.

The new committee's objectives were outlined in part during the meeting as follows:

1. To promote cooperation among various technical societies working in the field of corrosion.
2. To prepare and publish periodically a directory of corrosion workers in the United States.
3. To provide liaison among technical committee of N.A.C.E. and other technical societies.
4. To act in advisory capacity to technical societies interested in corrosion in an effort to promote progress of all and avoid duplication of effort.
5. To recommend in which society a proposed new activity might be carried out best without, however, at-

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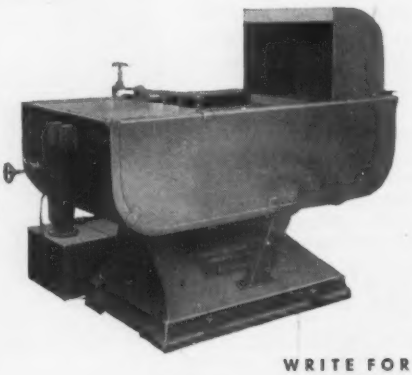

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tempting to define or limit the field of activity of any society.

6. To stimulate the publication of reliable data on corrosion and to provide publicity for conferences in this field.

The Inter-Society Committee will carry on some activities of the former American Coordinating Committee on Corrosion and the N.A.C.E. Committee on Relations with Other Technical Societies, both of which it has succeeded.

ELECTROCHEMICAL SOCIETY

Spring Convention To Be Held in May

The Spring Convention of the Electrochemical Society will be held in Philadelphia on May 4-5-6-7, 1949. Convention headquarters will be at the Benjamin Franklin Hotel. In addition to the technical program, which again promises to be outstanding, a considerable number of social functions have been planned, including a program of entertainment for the ladies.

A symposium on "Theoretical Electrochemistry" will feature the technical program. Other subjects under discussion will be "Rare Metals and Luminescence," and "Materials of Construction for Chlorine-Alkali Plants." It is also planned to have a group of industrial plants available for inspection trips. Chairman of the committee is *Mr. Ernest G. Enck.*

AMERICAN SOCIETY FOR METALS

New Committee Appointments

Important national committees of the American Society for Metals have recently been completed.

Additions to the Advisory Committee on Metallurgical Education are: *A. R. Troiano*, Professor of Metallurgy, Notre Dame; *John Chipman*, Professor of Metallurgy, M.I.T.; *Harry P. Croft*, V.P. in Charge of Research, Wheeling Bronze Casting Co.; *M. A. Grossmann*, Director of Research, Carnegie-Illinois Steel Corp.; *Dr. Alfred Bornemann*, Stevens Institute of Technology; *Robert F. Mehl*, Director Metals Research Lab., Carnegie Institute of Technology; *John W. W. Sullivan*, American Iron and Steel Institute; *Nicholas J. Grant*, Massachusetts Institute of Technology; *M. A. Hunter*, Dean of Faculty, Rensselaer Polytechnic Institute; *L. M. Pidgeon*, Professor Metallurgical Engineering, University of Toronto.

Three names have been added to the Constitution and By-Laws Committee. They are: *F. A. Forward*, Head, Dep't of Mining and Metallurgy, University of British Columbia; *W. J. de Mauriac*, Philadelphia Electric Co., and *Fred J. Robbins*, Sierra Drawn Steel Corp.

The Educational Committee advances member *H. B. Knowlton*, International Harvester Co. to the Chairmanship, with *Chas. F. Lewis*, Metallurgical Engineer, Cook Heat Treating Co., and *K. L. Fetters*, Special Metallurgical Engineer, Youngstown Sheet and Tube Co., as new members.

J. B. Austin, Director of Research, United States Steel Corp., is the new member of the ASM Finance Committee.

On the Metal Progress Advisory Committee, two new names will appear during the current year: *J. G. Hana-*

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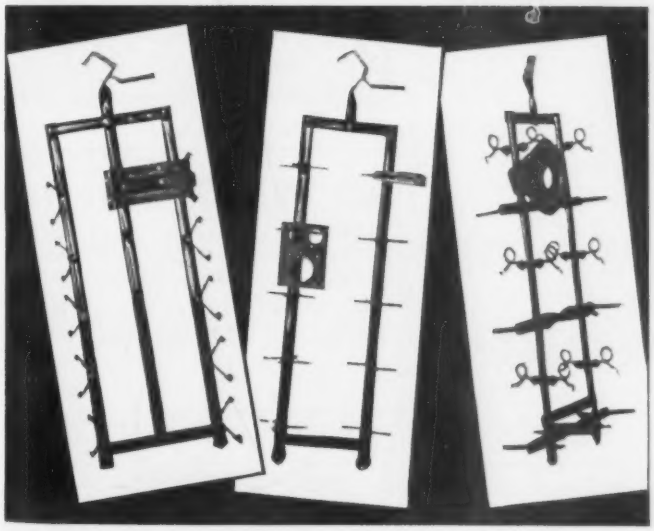

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walt, Manager, Magnesium Division, Dow Chemical Co., and *Howard Scott*, Manager, Metallurgical and Ceramic Departments, Westinghouse Electric Corp.

J. B. Johnson, Chief Materials Laboratory, Air Materials Command, Dayton, Ohio, becomes Chairman of the Metals Handbook Committee, with three new members appointed: *Pete Payson*, Crucible Steel Company of America; *M. Hansen*, Associate Professor, Illinois Institute of Technology, and *Bruce W. Gonser*, Battelle Memorial Institute.

The ASM Publications Committee names a new Chairman—*Robert H. Aborn*, Department of Physical Metallurgy, United States Steel Corp. New members of this Committee include: *C. C. Donoho*, Chief Metallurgist, American Cast Iron Pipe Co.; *W. M. Baldwin, Jr.*, Research Professor, Case Institute of Technology; *Edgar Brooker*, U. S. Spring and Bumper Co.; *W. E. Mahin*, Chairman, Metals Research, Armour Research Foundation; and *Alvin J. Herzig*, Experimental Laboratory, Climax Molybdenum Company.

Max Gensamer, Carnegie-Illinois Steel Corp., becomes Chairman of the Seminar Committee of ASM with four new members added. They are: *Clarence Zener*, Institute for the Study of Metals, University of Chicago; *Morris Cohen*, Professor of Metallurgy, M.I.T.; *John H. Hollomon*, Research Laboratories, General Electric; and *R. M. Brick*, Director of Metallurgical Engineering Department, University of Pennsylvania.

A. E. White, Director of Engineering Research, University of Michigan, will represent ASM in the National Association of Corrosive Engineers.

News from California

Handy & Harman, Los Angeles, completed an addition to its local plant providing for 25% increase in manufacturing and refining facilities, and a new precious metal assay laboratory.

J. M. Bowman has acquired the interest of A. J. Ahschlager in *Dulite Chemical Products*, 4506 *Long Beach Avenue, Los Angeles*, and now operates the firm as sole owner. The firm serves as Pacific Coast representative for Du-Lite Chemical Corp. and Enthone Products. The firm name has been changed to Bowman Chemicals, Inc. *Walter Luitjen*, formerly with the Turco organization in Los Angeles, has been appointed a sales engineer.

Hal Hudson, advertising manager for *Industrial Electronics and Transformer Co., Los Angeles*, returned late in February from a month's business trip to Europe. He visited Ireland, England, France, Holland, Denmark and Switzerland, calling on firms that use the Los Angeles company's aircraft ground starting equipment, transformers and rectifiers. The company also produces equipment for the electro-plating field

A visitor to Los Angeles in January-February was *Mr. M. Messing* of the Bart-Messing Co., Brooklyn, N. Y. One

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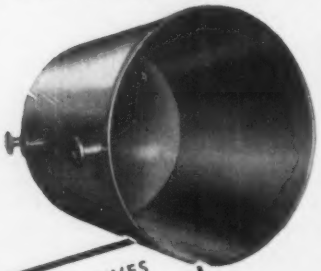

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of the purposes of his trip West was to make arrangements for a West Coast distributor for the Bart-Messing line. He also visited the plant of the International Rectifier Corp. in Los Angeles for business conferences with general manager *Eric Lidow*.

A series of night school courses covering basic theories and properties of iron, steel and non-ferrous metals and their alloys is being conducted at the Los Angeles Junior College by *E. K. Smith*, consulting metallurgist.

Manufacturers' Literature

Anhydrous Hydrofluoric Acid

Harshaw Chemical Co., Dept. MF, 1945 E. 97th St., Cleveland, O.

Just issued by this firm is a new 36 page booklet on the properties and uses of anhydrous hydrofluoric acid, and it constitutes one of the most complete compilations of data on the subject ever assembled into a single publication. Methods of handling and materials of construction are treated in detail, and typical applications in industrial processing are covered. Copies are available at no charge.

Ferric Chloride Booklet

Pennsylvania Salt Mfg. Co., Dept. MF, 1000 Widener Building, Philadelphia 7, Pa.

A simplified, concise manual on the properties, uses and methods of handling Ferric Chloride has been prepared for distribution among engineers, superintendents and operators of industries where the chemical is applicable.

The 12-page leaflet lists and comments on the most important uses of Ferric Chloride: as ferric coagulants in the precipitation of sewage and sewage sludge conditioning; to form iron salts as a mordant in dyeing; as an etch in photo-engraving; a coagulant in glycerine manufacture; as a catalyst in oil refining and organic reactions.

The booklet contains information on Pennsalt's two commercial forms of the product, listing their characteristics and equipment recommended for their use.

Copies of the booklet, entitled "Anhydrous Ferric Chloride," may be obtained on request.

New Dust Collector Catalog

Torit Mfg. Co., Dept. MF, 303 Walnut St., St. Paul 2, Minn.

Economical, low-cost methods for collecting and cleaning dust laden air from around industrial machines are outlined in the new Torit catalog, No. 34. Just off the press, this publication includes complete information on the Torit line of self-contained and cyclone type dust collectors. It also described recent improvements made in certain models and accessories.

Galvanic Cell Corrosion

The International Nickel Company, Dept. MF, New York 5, N. Y.

Reasons for galvanic cell corrosion, as well as methods for helping to overcome it, are contained in a new booklet issued by The International Nickel

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It is available without cost.

Permanent Magnet Catalog

General Electric Co., Chemical Dept. Pittsfield, Mass.

A 28-page illustrated catalog (CDM-2A) describing stocked G-E permanent magnets has been issued by the above firm. A wide variety of cast and sintered Alnico magnets, as well as special magnetic alloys, are listed.

The catalog is devoted to photographs and pull curves illustrating many stocked magnets, and includes drawings of all stocked patterns. Procedures are outlined for requesting quotations and obtaining magnet design assistance from General Electric engineers. Property tables are included for reference.

Copies may be had by writing to the above address.

Industrial Dermatitis

L. E. Hicks & Son, Inc., Dept. MF, 507 S. Grove, Oak Park, Ill.

In simple, outline form Bulletin 222 --just released by this firm—summarizes the cost to industry of dermatitis, its prevalence in various branches of industry, and the methods of preventing it.

Actual figures from the U. S. Public Health Service are cited and adequate testimony is given to the effectiveness of Spun-Derma-C in fighting skin infection in all types of plants.

The bulletin is available on request.

Polishing Accessories

Trailer Lock and Body Co., Inc., Dept. MF, 448 N. Halsted St., Chicago 22, Ill.

A bulletin issued by this company lists the various items available from them for the polishing and buffing trade, including work holder spinners, tapered screw points, lathe collars, wheel balancing mandrels, wheel flanges, emery troughs and other specialized equipment. Copies of the bulletin are available without charge.

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Published by the American Society for Testing Materials, 1916 *Race St., Phila., Pa. Price* $1.00 *per copy.*

The three papers in this symposium consider some of the broad questions involved such as, How much testing is necessary so that good material will generally be accepted and poor material rejected?; if material from any one source is consistently good, are there any general principles governing the degree to which we can reduce the amount of testing as compared with that required when the quality is erratic? The following papers are included:

SAMPLING AND ITS UNCERTAINTIES—*S. S. Wilks, Professor of Mathematical Statistics, Princeton University, Princeton, N. J.*

ON VARIATIONS IN MATERIALS, TESTING, AND SAMPLE SIZES—*Leslie E. Simon, Colonel, Ordnance Dept., Director, Ballistic Research Labs., Aberdeen Proving Ground, Md.*

THE AMOUNT OF INSPECTION AS A FUNCTION OF CONTROL OF QUALITY—*G. R. Gause, Bell Telephone Labs., Inc., New York, N. Y.*

The Story of Magnesium

By W. H. Gross, American Society for Metals, 7301 Euclid Avenue, Cleveland 3, Ohio. 260 pages. 5 x 7½ Cloth $1.50.

The purpose of the new series is to provide young men and young women, not engineering graduates, with the technical information needed to properly understand the science of metals as it is applied in Industrial production. "The Story of Magnesium," for instance, is written in simple phraseology and has been reader-tested by the High School student. It is within the educational range of the High School student and of workers in industry who do not have professional or technical training.

It is believed that this and future techbooks will be suitable for use as self-educational material. The Society is vitally interested in making available a simplified interpretation of metal science so that the future generation of metal scientists will early undersand and appreciate the importance of the metal scientist. These techbooks can be used as texts, as a basis for fundamental lecture series, as supplementary reading for plant courses, and many other uses.

To aid instructors, the charts and illustrations in "The Story of Magnesium" have been made into a film strip which is available at low rental from the publishers.

Treatment and Disposal of Industrial Waste Waters

By B. A. Southgate. British Information Services, 30 Rockefeller Plaza, N. Y. 20. Price $3.65.

A general treatise on the waste water problems of various industries, including the electroplating and metal working plants. The effects of the various contaminants and methods available for their removal or transformation to a harmless state are covered. The author has had over 20 years' experience in this field, and therefore writes with a first-hand knowledge of the magnitude of the problems involved. While this book will not enable one to solve a specific pollution problem, it does point out the many factors that must be considered before any plan of progress can be made effective.

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1—HANSON-VAN WINKLE-MUNNING 2000/1000 ampere, 6/12 volt, 720 RPM. Exciter in head. Serial No. 9939.

1—L'HOMMEDIEU 3000/1500 ampere, 8/16 volt, 900 RPM. Exciter in head. Serial No. 1040.

1—HANSON-VAN WINKLE-MUNNING 4000/2000 ampere, 6/12 volt, 600 RPM. Exciter in head. Serial No. 9635.

2—Ideal Electric 5000/2500 ampere, 9/18 volt, 600 RPM. M.G. Exciter, Serial No. 112875—Serial No. 110705.

2—Chandeysson Electric 5000/2500 ampere, 9/18 volt, 400 RPM. Exciter in head, 25° C. Serial No. 30584—Serial No. 30587.

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